MATERNAL BEHAVIORAL HEALTH SYMPTOM PROFILES IN EARLY FAMILY LIFE: COMPLEXITY, SUPPORT, SERVICES USE, AND FUTURE RISK FOR DEPRESSION

by
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ABSTRACT

Objectives*:* Depression affects up to 20% of U.S. mothers in the perinatal and early childhood periods, yet few studies of non-clinical populations have examined how symptoms characteristic of depression and other mental health and/or substance use problems (i.e., behavioral health problems) cluster within mothers' experiences. This study aimed to characterize mothers' behavioral health symptom profiles, and their correlates, early in the family life cycle. It also aimed to examine how these symptom patterns were related to development of depression and use of behavioral health care, in order to inform prevention efforts and to improve health trajectories for mothers, families, and their children.

Methods: Data were from the Fragile Families and Child Wellbeing study, a national birth cohort of mostly unmarried mothers (*N*=4,205). Mothers reported 33 symptoms characteristic of four psychiatric disorders (probable major depressive episode, probable generalized anxiety disorder, probable alcohol dependence, and probable drug dependence) in their children's 3rd year. Latent class analysis (LCA) identified subgroups of mothers based on those symptoms. The extent to which symptom profiles differentially predicted future major depressive episode (MDE) in their children's 5th year and behavioral health care (BHC) use was investigated using logistic regression, adjusting for demographics, maternal reproductive health, functional limitations, and perinatal behavioral health. Moderation by social support and race/ethnicity was also explored.

Results*:* LCA identified five profiles: "Depression only" (14.5% of sample), "Severe depression and anxiety" (5.3%), "Anxiety only" (2.2%), "Depression and substance use" (1.4%) and 5) "Currently symptom free" (76.6%). Perinatal behavioral health risk was associated with all four symptomatic profiles. Women with profiles characterized by depression and co-occurring anxiety or substance misuse were at greatest risk for future MDE and use of BHC. Social support slightly attenuated future MDE risk. Black and Hispanic women and pregnant women were less likely to use BHC.

Conclusions: This study identified distinct behavioral health symptom profiles that cut across psychiatric disorders, had unique precursors, and differentially predicted MDE and BHC use. The disproportionately low levels of BHC use among pregnant women and women of color suggested missed opportunities for treatment and prevention of serious psychiatric disorders. Culturally acceptable, integrated BHC models, particularly in obstetrics and gynecology, should be prioritized.

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CHAPTER ONE

Background and Significance

INTRODUCTION

There is substantial unmet need for the management and treatment of maternal depression in the perinatal period, pregnancy through the first 12 months postpartum, as well as during the early parenting period among women in the U.S.,[1] despite recent attention by medical and public health organizations.[2] In particular, low-income women and racial/ethnic minority women are disproportionately less likely to engage in mental health care services, given need.[3] Unmarried mothers are particularly vulnerable as they are more likely to experience mental health problems,[4] have lower rates of health insurance, and are less likely to have social support.[5] However, there is a lack of non-clinical, population-based studies of these at-risk populations, and studies are needed to comprehensively describe symptom burden to inform mental health problem prevention efforts.

The majority of population-based studies of maternal mental health focus on depression, which is found to be the most common risk factor in pregnancy for serious pregnancy and birth complications.[6] However, disorder presentation varies by severity and the extent to which women experience anxiety and/or substance use symptoms. Taken together mental health and substance misuse symptoms are referred to as behavioral health symptoms. Disorder-based approaches may limit prevention efforts, as women may have symptoms that fail to meet diagnostic criteria and yet are still impairing and may signal risk for future disorder. Women with one type of behavioral health problem are also at higher risk for experiencing symptoms characteristic of other types. The extent to which mothers' behavioral symptoms cluster into distinct profiles is unknown. Also unknown is the extent to which these symptom profiles differentially predict future psychiatric disorder development and/or use of behavioral health

care (BHC). Moreover, there is a paucity of studies of behavioral health need or services use in non-clinical populations that are able to take into account maternal characteristics such as reproductive health, functional limitations due to health, relationship status, and social support.

Public health implications

Describing maternal behavioral health profiles during the critical perinatal and early parenting periods can build the scientific foundation for lifecourse models and studies of behavioral health. Untreated maternal depression and associated conditions can negatively impact parenting practices, family functioning, and child development.[7] By documenting how perinatal and other predisposing factors are associated with behavioral health conditions and development of depression this research helps to strengthen the evidence supporting a public health orientation toward reproductive mental health, with implications for health and wellbeing across multiple generations.[8] Finally, understanding the factors associated with use of BHC can support efforts to engage women with unmet needs into behavioral health treatment during this critical period in the life cycle.

RESEARCH QUESTIONS

In order to advance current scientific knowledge related to behavioral health and behavioral health care use among women in the perinatal and early parenting periods, this study sought to address the following research questions, which are examined in **Chapters three**, **four** and **five**:

Chapter three:

- Can subgroups of mothers (defined by their symptom profile) be identified based on mothers' self-reported depressive, anxiety, alcohol dependence, and drug dependence symptoms that occurred during their children's 3rd year of life?
- Which current and perinatal maternal characteristics are associated with belonging to a given symptom profile?

Chapter four:

- To what extent do the maternal behavioral health symptom profiles identified in **Chapter three** differentially predict probable major depressive episode two years later?
- Does the risk of future major depressive episode vary by level of instrumental social support?

Chapter five:

- To what extent do the maternal behavioral health symptom profiles identified in **Chapter three** differentially predict use of behavioral health care services in Year 3?
- Does the probability that women use behavioral health care vary by mothers' racial/ethnic identification?

The remainder of this chapter summarizes the current scientific literature motivating these questions, explains the conceptual framework that guides this work, and lastly, describes this study's specific aims and associated hypotheses.

BACKGROUND AND SIGNIFICANCE

Maternal behavioral health problems negatively impact health during critical periods

Depression affects 10 to 20% of U.S. mothers at any given time, amounting to roughly 15 million children living in families affected by maternal depression.[9] Even more mothers and their families are affected by subclinical symptoms, which can also be impairing.[10] In addition, women with depression are at increased risk for co-occurring anxiety and substance misuse symptoms.[11–14] Behavioral health problems elevate risk for suicide[15] and romantic and parenting relationship problems[16] for mothers, and increase rates of preterm birth,[6] behavior problems,[17,18] and inadequate preventive health care for children.[19]

The perinatal and early childhood periods represent stages in the family life cycle characterized by quickly-changing developmental needs of children and, for parents, the competing demands of work and/or managing households and child rearing.[20,21] These periods are critical to children's health and development, which are highly dependent on the extent to which parents engage in responsive caregiving, provide safe physical environments, provide healthy nutrition, and model other health-promoting practices.[22] Maternal behavioral health symptoms can disrupt the family system and contribute to a negative trajectory for the entire family.[23]

Public health and medicine recognize the importance of screening; progress has been insufficient

Recognizing the evidence related to the health risks of perinatal mood disorders as well as the availability of standardized assessment tools, professional organizations representing obstetrics and gynecology, pediatrics and public health all recommend screening at least once in the perinatal period.[2,24–26] Despite these guidelines, screening is far from routine, and, even when

women are screened, referral, follow-up, and mental health treatment rates among perinatal women are low.[1,27] A recent review paper found the only half of women are screened for depression in pregnancy and about a third in the postpartum period.[1] Of those with depression, 13.6% and 15.8% of women received any mental health treatment in the pregnancy and postpartum periods, respectively.[1] Because many mothers have frequent interactions with pediatricians in the early years of their children's life there are also opportunities to address maternal behavioral health in primary care pediatrics. However, a recent survey of pediatricians found that only 46% often ask mothers about depression and only 20% ask about parental substance use.[28] Characterizing maternal behavioral health profiles in a manner that better reflects the presentation of women being treated in obstetrics and in other primary care settings, as well as the long-term risks of these profiles, may encourage providers to find better ways of addressing the needs of these patients.

Most studies are based on a single disorder and most focus on depression

Despite the high likelihood that women with depression will also experience symptoms characteristic of other psychiatric disorders, most studies of women's behavioral health have focused on a symptoms characteristic of a single probable disorder defined categorically, such as depression[29–31] or a narrowly defined behavior, such as alcohol use.[32] A notable exception includes the Postpartum Depression: Action Towards Causes and Treatment (PACT) Consortium study, which included symptom-level data to describe phenotypes of depression and anxiety in a large international sample of clinical populations.[33,34] A separate population-based study showed significant overlap between depressive and anxiety symptoms in the first four months postpartum.[14] To our knowledge, no study has included mothers' mood disorder and alcohol and

drug dependence symptoms to identify broad behavioral health profiles in non-clinical populations of women. The ways that young mothers experience combinations of behavioral health symptoms in a large non-clinical population is unknown. In particular, there are limited non-clinical estimates of anxiety disorders among women in the perinatal period.[35,36] Thus there is a need to characterize current symptom burden among mothers, based on symptoms of multiple disorders, to inform risk stratification.

One approach to studying symptom burden is to conduct person-based studies. Compared to variable-based studies that quantify relationships among variables, person-based studies aim to identify characteristics of subgroups of a population based on a common patterns of symptoms. In addition, disorders are typically assessed in terms of the symptom criteria needed for a DSM/ICD diagnosis.[37] This approach can limit the preventive relevance of research given that symptoms themselves may indicate the earlier stages of a disorder and can cause impairment in functioning even below diagnostic thresholds. The Research Domain Criteria Initiative (RDoC) is one attempt to respond to these limitations, providing a new approach for studying domains of functioning by integrating multiple levels of information to better reflect the experience of behavioral health problems.[37,38] Person-based studies can provide a more complete picture of women's lived experiences of behavioral health problems, and may give some indication as to where a person is in her disorder development. They can also help estimate more precisely the extent to which currently symptomatic women are likely to experience future psychiatric disorders. Finally, the likelihood that women with various behavioral health symptom profiles use behavioral health care services (i.e., psychiatric medication and/or counseling for mental health or substance misuse problems) is unknown.

Populations of mothers more likely to have unmet behavioral health need

Unmarried mothers are at particular risk for economic adversity, relationship instability, and a range of other psychosocial risks associated with higher psychological distress, compared to married mothers.[39–41] Given that the overall prevalence of children born to unmarried mothers in the U.S. rose from 5% to 40% between 1960 and 2015,[42] this "fragile families" population is of high public health importance. Beyond marital status, social support resources are likely important determinants of mothers' mental health. Studies have linked emotional support[43] and instrumental[44] support to reductions in perinatal depressive symptoms. However, the extent to which instrumental support is associated with changes in behavioral health symptoms over time is unknown.

Black and Hispanic mothers are less likely to receive adequate or any mental health care for depression.[3] One reason for racial/ethnic disparities appears to be differences in beliefs and attitudes related to help-seeking. For example, a study from the Early Childhood Longitudinal Study (ECLS) found that, among moderately to severely depressed mothers at 9 months postpartum, minority women and foreign-born women were twice as likely to think they did not need help compared to white, U.S.-born women.[45] Additionally, in a review paper of 40 qualitative studies of help-seeking for postpartum depression, black mothers described managing depression by "keeping the faith" or "keeping secrets" and that some believed that "depression was a sign of internal weakness and not a legitimate illness" and depression was a "failure of motherhood."[46] In contrast, a study drawn from a clinical population found limited evidence of health belief differences regarding mental health care between minority women and white women already in care.[47] Other barriers to care for women of color include health care system-

level factors such as poor provider-patient communication, the unbalanced geographic distribution of providers, and a lack of culturally acceptable mental health services.[48] More research is needed to examine the association between behavioral health need and BHC use among a diverse non-clinical population of mothers.

The next section describes the theoretical and conceptual underpinnings of this study, demonstrating the utility of looking at maternal behavioral health and health services use from a multilevel lifecourse perspective.

A CONCEPTUAL FRAMEWORK OF MATERNAL BEHAVIORAL HEALTH

The conceptual framework that guides this study integrates: 1) the concept of a behavioral health "illness career" and Network Episode Model, 2) a lifecourse approach to maternal behavioral health, and 3) Andersen's behavioral health model of health care utilization. This section first describes the theories and models that informed the development of this study's conceptual framework and then presents a diagram of the study's conceptual framework based on those theories and models.

The concept of an illness career. An "illness career" refers to an individual's lifetime history of substance use and/or mental health episode(s) coupled with their use (or nonuse) of behavioral health care over time. This longitudinal perspective has advanced the field by recognizing that the often persistent and recurring course of psychiatric conditions requires a lifecourse perspective on behavioral health and need for services.[49,50] This framework has the potential for capturing the unmet behavioral health care need of different sub-populations over their

lifecourse.[49–51] Behavioral health care use is an important part of an "illness career" because of its potential to lessen the negative impact of behavioral health problems on women, children and families, by reducing symptoms, improving family functioning and coping skills,[52] and possibly fortifying against future recurrence.[53]

Network Episode Model. There is wide variability in behavioral health illness careers, related to factors such as age of symptom onset, severity and symptom mix of disorder(s), whether or not treatment is sought, and if and when recovery and/or remission occurs. Pescosolido and Boyer characterized potential pathways into and out of mental health care with the Network Episode Model (NEM).[54] The NEM posited that the illness career is influenced by the social support system, the treatment system, and social context. Based on qualitative work with individuals in mental health treatment, Pescosolido and Boyer categorized entries into care as either "by choice," "by coercion," or "muddling through."[51] Thus, the NEM model underscores the dynamic nature of the factors that influence illness careers as well as the range of within-person experiences over time. This 'long game' approach is in-line with taking a lifecourse perspective on maternal behavioral health risk and services use.

Behavioral health from a lifecourse perspective. From a lifecourse perspective, this dissertation aimed to describe two critical periods in the family life cycle: transition to parenthood and parenting young children. Not only are women at increased risk for mood disorders in the postpartum period,[34] but the early parenting period is also a critical time in children's health and development. Taken together, the NEM and lifecourse perspective on health both highlight the

importance of studying individuals' need and mental health services use patterns longitudinally as well as the need to examine the social context factors related to those patterns.

Andersen's Behavioral Health Model of health care use. Andersen's revised Behavioral Model (ABM) of health care utilization is commonly used to describe the factors that contribute to disparities in BHC use.[55,56] The ABM posited three dynamic tenets of health care services use: predisposing, enabling, and need characteristics.[57]

Predisposing factors are characteristics of an individual that exist prior to the onset of health need and influence the likelihood of health care use.[57] The strongest and most consistently demonstrated predisposing characteristic of maternal behavioral need is a prior history of mental health problems.[58] Maternal behavioral health need is also associated with age of symptom onset,[34] transition to parenthood, parity,[59] pregnancy and obstetrical complications,[33,34] inadequate social support,[60] and physical health problems.[61]

Enabling factors are conditions that make the use of health care services more likely, such as having health insurance and transportation.[57] Healthcare financing policies also play an important role in faciliating BHC use. For example, Medicaid covers nearly half of the perinatal medical care in the U.S.,[62] as well as a disproportionate amount of individuals with behavioral health problems,[63] underscoring the profound impact Medicaid reimbursement policy has on health care for single mothers with behavioral health needs.

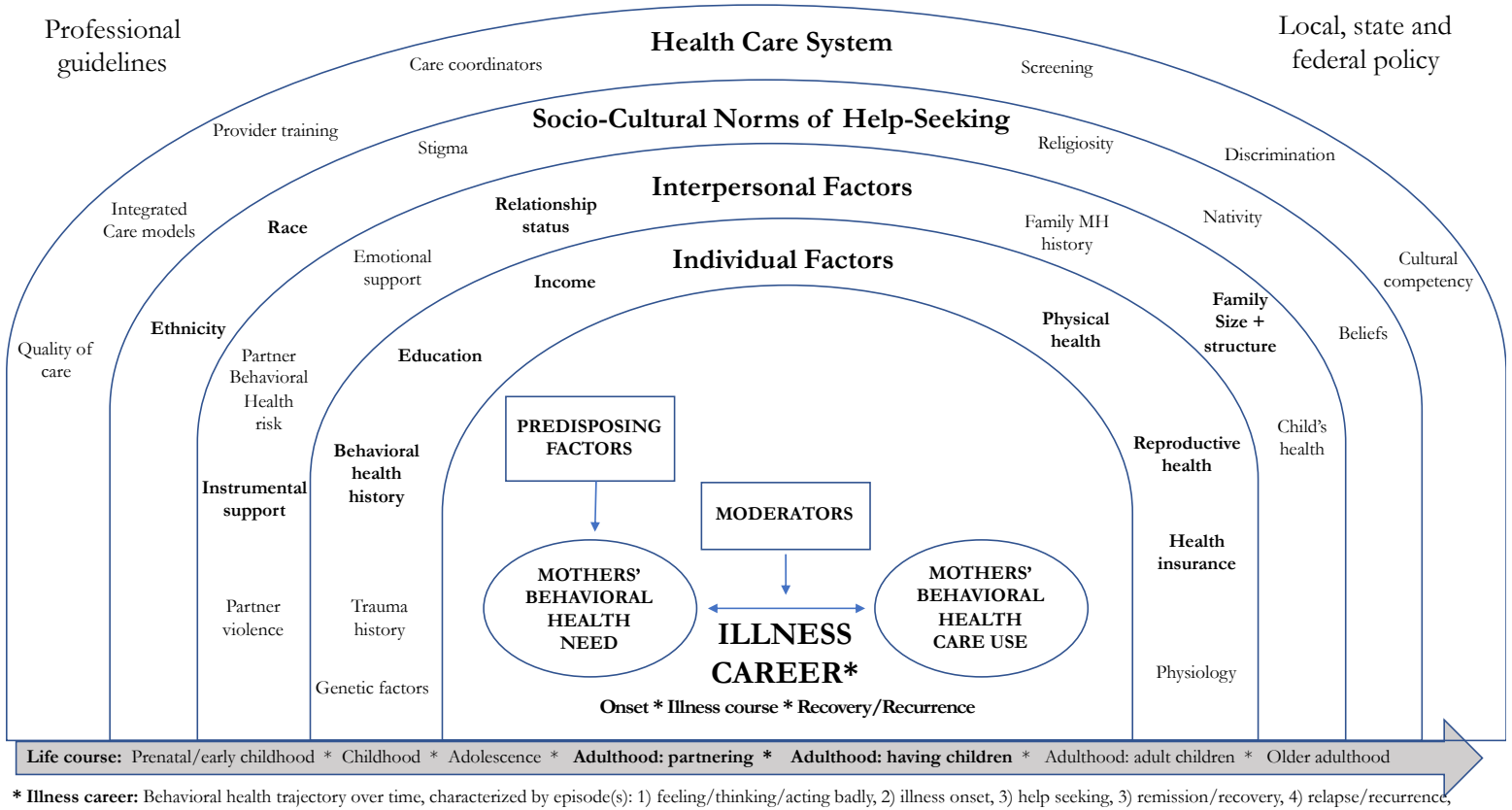
Lastly, both the extent to which a person believes they need care, as well as a medical provider's diagnosis of that need, are likely the most important predictors of health care use.[57] Studies of the general U.S. population showed that the use of mental health services, as well as how timely that care is received, varied considerably by disorder severity and type.[64,65]

The conceptual framework diagram. Figure 1.1 presents a diagram of this study's conceptual framework. The components of the illness career (in the center of the model) include behavioral health need (i.e., symptoms, severity) and mental health care use (i.e., counseling, medication, timing, dosage, quality). There is a bidirectional relationship between need and use of services, indicated by double arrows. Further, this relationship is potentially moderated by a range of enabling factors, such as having health insurance. Need is also influenced by predisposing factors that can occur proximally in time to the illness episode (e.g., a pregnancy loss) or chronologically more distant such as the experience of a childhood trauma. Therefore, the illness career is influenced over time, horizontally, by various factors that increase women's vulnerability to behavioral health problems later in life. The illness career is also influenced vertically, by individual, interpersonal, and socio-cultural levels. Individual and interpersonal factors are nested within larger environmental contexts, which include the "socio-cultural norms of help-seeking" (e.g., stigma, beliefs and attitudes about behavioral health treatment) and the "health care system" (e.g., health care models). And lastly, the entire model is nested within the context of health care policy and professional guidelines (e.g., American College of Obstetricians and Gynecologists' recommendations about perinatal screening). The grey arrow across the bottom of the figure represents the life cycle period focus: the perinatal and early

parenting periods. Specific maternal characteristics that were examined in this study are **bolded** in the figure.

Studying mental health is a complex undertaking partly because, as sociologist Linda George so aptly described, it is "a moving target."[49] She continued, "Mental health is a moving target across the lifecourse. It is always at risk as traumas and stressors take their toll on our bodies and minds. At the same time, protective factors, especially psychosocial resources, help us to weather those storms to the extent that most of us avoid mental illness most or all of our lives."[49] The next section describes the specific aims and related hypotheses that were tested in this study, an attempt to study at least some of the aspects of this "moving target" in a framework that can be applied to public health policy and program efforts to promote behavioral health and prevent behavioral health problems during this critical life period.

Figure 1.1 Conceptual Framework: A Lifecourse Perspective on Maternal Behavioral Health



*** Illness career:** Behavioral health trajectory over time, characterized by episode(s): 1) feeling/thinking/acting badly, 2) illness onset, 3) help seeking, 3) remission/recovery, 4) relapse/recurrence, 5) adaptation to chronic impairment [individual's career highly dependent upon exact nature of behavioral health risk/disorders]
Factors included in this study are in **bold**.

AIMS AND HYPOTHESES

The study's aims are depicted in Table 1.1. **Aim 1** described the current behavioral health symptom burden of mothers in the 3rd year of their children's life, taking a person-based approach. The Aim 1 hypotheses would not be supported if describing symptom profiles did not work (**Hypothesis 1.1;** e.g., if the statistical models failed to converge or the profiles were not clinically meaningful); this would indicate that other methodological approaches were more suitable. If maternal characteristics were not associated with symptom profiles (**Hypothesis 1.2)**, this could indicate that such factors were indeed unrelated, or that the population of interest did not have enough variability or sample size to make valid estimates.

Aim 2 predicted mothers' risk of a future major depressive episode based on their behavioral health symptom profile. It also estimated whether and the extent to which this risk varied by instrumental social support. If this risk did not vary by profile **(Hypothesis 2.1)** this would indicate that there were not clinically meaningful differences in the prodromal or predictive characteristics of symptom profiles. Further, if instrumental social support did not ameliorate risk of future disorder (**Hypothesis 2.2)** this may have meant that social support was unimportant, that the instrumental social support measure does not adequately capture the mechanisms by which social support moderates risk of symptoms, or that unmeasured factors (e.g., health care system-level factors, mental health care) accounted for the variation in risk of future probable depressive disorder.

Aim 3 investigated whether symptom profiles differentially predicted mental health care use. We hypothesized that they would differentially predict use (**Hypothesis 3.1)** and that mothers with

more severe symptoms would be most likely to report BHC use. If this was not supported, this would have meant that the profiles did not reflect the severity of need and/or that unmeasured factors, (e.g., health care system-level factors) accounted for the variation in BHC use. We hypothesized that the maternal factor most strongly correlated with BHC use would be having health insurance (**Hypothesis 3.2)**. We also hypothesized that black and Hispanic women would be less likely than white women to use BHC, across all behavioral health profiles and adjusting estimates for other maternal characteristics likely to vary by race/ethnicity (**Hypothesis 3.3)**. If we did not find symptom profile-specific racial/ethnic differences, this would have meant that other maternal characteristics, potentially those unmeasured in our study, accounted for variation in BHC use.

Table 1.1 Study Aims and Hypotheses

Aims	Hypotheses
Aim 1: To describe maternal behavioral health profiles based on symptoms characteristic of multiple psychiatric disorders	
Aim 1.1 To characterize subgroups of mothers, based on unique symptom profiles (including depressive, anxiety, alcohol dependence, and drug dependence symptoms) during their child's 3rd year.	**Hypothesis 1.1** Symptoms characteristic of four probable disorders (depression, anxiety, alcohol dependence, and drug dependence), can be analyzed to identify meaningful person-based maternal behavioral health symptom profiles.
Aim 1.2 To identify maternal characteristics associated with each symptom profile (including demographic, reproductive health, health limitations, and perinatal behavioral health problems).	**Hypothesis 1.2** Mothers in symptomatic profiles will be disproportionately more likely to be low-income, single, and to report a history of perinatal behavioral health risk than those in the symptom-free profile.
Aim 2: To predict mothers' risk of a future major depressive episode, based on their behavioral health symptom profile	
Aim 2.1 To estimate the association of behavioral health symptom profiles among mothers in their children's 3rd year with the risk of major depressive episode (MDE) two years later, in children's 5th year.	**Hypothesis 2.1** Various maternal behavioral health profiles will differentially predict future MDE risk; women in more severe profiles will have the highest probabilities of future risk.
Aim 2.2 To quantify the extent to which the relationship between behavioral health symptom profiles and subsequent MDE is moderated by instrumental social support.	**Hypothesis 2.2** Adjusting for covariates and for each profile, mothers reporting high (versus low) instrumental social support will have a lower probability of MDE.
Aim 3: To predict the probability of behavioral health care (BHC) use based on mothers' behavioral health symptom profile	
Aim 3.1 Predict the behavioral health profile-specific probability of BHC among mothers in their children's 3rd year.	**Hypothesis 3.1** Maternal behavioral health profiles will differentially predict BHC use; women in more severe profiles will have the highest probabilities of BHC use.
Aim 3.2 Identify maternal characteristics associated with the probability of BHC use.	**Hypothesis 3.2** Having health insurance will increase the probability of BHC use and black and Hispanic women will be less likely to use BHC, adjusting for covariates.
Aim 3.3 Quantify the extent to which the relationship between behavioral health symptom profiles and BHC use varies by race/ethnicity.	**Hypothesis 3.3** Adjusting for covariates and for each profile, black and Hispanic women (compared to white women) in each symptom profile will be less likely to use BHC.

DISSERTATION OVERVIEW

Dataset rationale

The Fragile Families and Child Wellbeing (FFCW) study presented an excellent opportunity to study maternal behavioral health profiles, mental health care use, social support, and variation by race/ethnicity. The FFCW is a national birth cohort study of approximately 5,000 children born between 1998 and 2000 and their biological mothers and fathers. Study investigators oversampled non-marital births to explore the influences of diverse family structures on the lives of parents and their children over time. While the FFCW was not primarily designed to study mental health care use, it includes repeated and validated subscales measuring depression, anxiety, drug and alcohol dependence, as well as mental health care use items. It also includes information about time-varying and invariant maternal characteristics important to this study, including measures related to perinatal behavioral health, reproductive health, functional limitations, instrumental social support, health insurance, and demographics. Taken together, FFCW participants represent an important population to study as they are majority low-income, racially and ethnically diverse, and are mostly unmarried. Further, FFCW mothers were sampled from a non-clinical population, allowing us to describe predictors of behavioral health care use as well as risk for subsequent depression among mothers with a range of behavioral health symptoms.

Intended outcomes of the study

The intended outcomes of this study were as follows. First, by better characterizing maternal behavioral symptom profiles and maternal characteristics related to these profiles, health providers and prevention specialists will be better equipped to tailor screening, referral,

and treatment strategies. Second, better understanding the symptom profile-specific future risk of psychiatric disorder development, as well as potentially malleable factors related to that risk, will inform perinatal mood disorder prevention efforts.[8] And lastly, examining maternal characteristics that are associated with differential probability of mental health care use during the early parenting years will inform policy and multidisciplinary provider and health system efforts to improve maternal behavioral health.

Overview of remaining chapters

Chapter two describes the research design and analytic methods employed to test the study's hypotheses. **Chapters three, four** and **five** are stand-alone publishable papers—each with their own background literature, methods, results and discussion sections—dedicated to addressing the research questions, aims and hypotheses of this study. **Chapter six** summarizes the overall study findings and describes their implications for public health policy, practice, and research.

CHAPTER TWO

Methods and Research Design

INTRODUCTION

This chapter describes the research design and analytic methods employed to test the study's hypotheses. For **Aim 1** we employed latent class analysis (LCA) to identify unique subgroups of mothers based on behavioral health symptom profiles during their children's 3rd year (i.e., Year 3). Then, we estimated the association of maternal characteristics with belonging in each of the symptom profiles using multinomial logistic regression models. In **Aim 2** we examined the association of Year 3 maternal behavioral health profiles and future risk for major depressive episode (MDE) two years later (i.e., Year 5) with logistic regression. We also assessed whether MDE risk varied by mothers' level of instrumental social support. And lastly, in **Aim 3** we estimated the association of maternal behavioral health symptom profiles with behavioral health care (BHC) use in Year 3 using logistic regression; we also evaluated the extent to which that association varied by maternal race/ethnicity.

FRAGILE FAMILIES AND CHILD WELLBEING STUDY

From 1998 to 2000, researchers from Princeton and Columbia Universities recruited a nationwide sample of 4,898 births, the Fragile Families and Child Wellbeing Study (FFCW). Because the study's investigators were particularly interested in the long-term child and family impacts of births to unmarried parents (i.e., "fragile families"), that population was oversampled such that three quarters of the sample was unmarried though only 33% of U.S. mothers were unmarried at that time.[42] Of 77 U.S. cities with populations larger than 200,000, 16 were randomly selected for inclusion based on a stratified sample of those cities—the stratification was based on labor market strength, welfare policy benefits, and child support enforcement—and 4 additional cities were chosen based on funder priorities. Within those cities, 75 hospitals were

selected. Births were then randomly selected from each hospital. Additional details were described in the initial FFCW design paper.[66]

Study enrollment occurred within days of the index child's birth in the hospital (i.e., baseline). Follow-up assessments occurred when the index child was 1, 3, 5, 9 and 15 years old. The baseline maternal interview took roughly 30-40 minutes and was administered by trained interviewers. Subsequently, mother questionnaires were administered by phone at Years 1, 3, and 5. In each wave, mothers were asked questions about their relationships, their physical and mental health, parenting, and a range of child outcomes. Sample sizes and follow-up rates for the periods of interest in this dissertation (i.e., perinatal and early childhood periods) are summarized below in table 2.1. Reasons for drop out (by the Year 5 wave) are summarized in Table 2.2.

Table 2.1 Sample Sizes and Follow-Up Rates, Baseline through Year 5

	Baseline	**Year 1**	**Year 3**	**Year 5**
Lifecourse period	(birth)	(postpartum/infancy)	(early childhood)	
Sample size	4898	4343	4205	4100
Follow-up (%)	100.0	88.7	85.9	83.7

Table 2.2 Reasons for Missingness at Year 5 Wave (N=798)

Reason	**n**	**%**
Mother died	16	2.0
Child died	42	5.3
Child adopted/neither parent is primary caregiver	91	11.4
Other ineligible	5	0.6
Refused	180	22.6
Could not locate	316	39.6
Other reason for non-response	148	18.5
Total	**798**	**100.0**

Demographic characteristics of FFCW participants

At baseline, mothers were, on average, 25.3 years old (range=15 to 43 years) and just over a third (38.2%) were first-time mothers (range=1-13 biological children). Given the oversampling of non-martial births, FFCW mothers were disproportionately more likely to be unmarried, to identify as racial/ethnic minorities, and to be low-income compared with the overall U.S. population of mothers at the time (Table 2.3). Other studies of FFCW participants demonstrated substantial family structure change and complexity over time. One study found that through Year 9, almost half of families (43%) lived in a three-generational household (i.e., child, mother and grandparent) at some point.[67] Another study described the instability of mothers' relationships during the first five years of their children's lives. During this period, mothers were: 1) stably married (20%), 2) moved from cohabitating to married (8%), 3) stably cohabitated (7%); 4) were stably single (14%), 5) unstably cohabitating (7%), 6) unstably married (4%), 7) unstably single (25%), 8) and married to a new partner (4%).[68] In that particular study, instability was found to be a more important predictor of child wellbeing than family structure measured at one time point (e.g., at birth or at Year 5).[68]

Table 2.3 Sample Descriptive Characteristics at Baseline, *N*=4898

	n*	**%***
Mother's age (years)		
Age range: 15-43 years (*M, sd*)	25.3	(6.0)
15-24 Years	2599	53.1
25-34 Year	1835	37.5
35 years and over	460	9.4
Biological children		
Range: 1-13 children (*M, sd*)	2.2	(1.4)
First time mother (1 child)	1870	38.2
2 children	1556	31.8
3 children	784	16.0
4+ children	664	13.6
Missing	24	0.5
Race/ethnicity		
White, non-Hispanic	1030	21.0
Black, non-Hispanic	2326	47.5
Hispanic	1336	27.3
Other	194	4.0
Missing	12	0.2
Relationship with biological father		
Married	1187	24.2
Cohabitating	1783	36.4
Not cohabitating; together romantically	1274	26.0
Not together	652	13.1
Missing	2	0.0
Maternal education		
< High school	1699	34.7
Completed high school	1480	30.2
Any post-secondary	1713	35.0
Missing	6	0.1
Household income as percentage of federal poverty line (FPL)		
Near poor/poor (<99% FPL)	1771	36.2
Low income (100-199% FPL)	1262	25.8
Middle or high income (200%+ FPL)	1864	38.1

* *N* and % unless otherwise specified.

PRIMARY MEASURES OF INTEREST

Maternal behavioral health symptoms. To establish the presence of a psychiatric disorder, the gold standard of assessment is a standardized, validated, structured, in-person interview, conducted by a trained lay interviewer. For each of the psychiatric disorders in the Diagnostic and Statistical Manual, 5th Edition, these criteria include: symptom type, frequency, intensity, duration, associated distress and impairment in functioning.[69] In this study, mental health and substance use symptoms were assessed over the phone by trained interviewers using four subscales of the Composite International Diagnostic Interview – Short Form (CIDI-SF 1.0)[70] shown to have good validity[71] and reliability[72] in a range of populations.[73] Past year major depressive episode and generalized anxiety disorder questions were administered to mothers when the focal child was one and three years old (i.e., Year 1 and Year 3). Thus, the report of symptoms reflect experiences over the prior year of the mothers' and child's life. Alcohol and drug dependence questions were administered at Year 3. Each behavioral health scale began with screening questions referencing a time frame. Only if the screener question(s) were endorsed were additional symptom questions asked (see Table 3.1 for scales and items). This symptom list was the basis for identifying person-based behavioral health profiles in **Chapter three**, that were then used to characterize mothers' behavioral health experiences in **Chapter four** and **Chapter five**.

Behavioral health care use. Women were considered to be users of BHC if they reported that in the past 12 months they regularly took psychiatric medication for either depression or anxiety and/or received counseling or therapy for personal problems. These questions were not asked in the Year 1 survey.

Other maternal characteristics included demographics, reproductive health, social support and perinatal behavioral health risk. Table 2.4 summarizes how these measures were operationalized in this study.

Table 2.4 Maternal Characteristics Measured in this Study and Corresponding Data Waves

Measure	Responses and Variable Definitions	Waves
Demographic characteristics		
Maternal age	<25 years; 25-34 years; 35 years and older	All
Maternal education	Less than high school; completed high school; any post-secondary education	Baseline
Race/ethnicity	Non-Hispanic white; non-Hispanic black; Hispanic; other	Baseline
Household income as a percentage of the federal poverty line (FPL)	Near poor/poor (<99% FPL); low income (100-199% FPL); middle or high income (200% FPL)	All
Health insurance	Uninsured; Medicaid; private	Year 3
Interpersonal factors		
Relationship with biological father	Married; cohabitating; not cohabitating but together romantically; in another relationship; single	All
Instrumental social support	Based on the following questions: "Do you have someone who can provide you with a) emergency childcare, b) a place to live, and c) a loan for $200?" Dichotomized as: "low" with 0 or 1 yes and "some" with 2-3 yeses.	Year 3
Reproductive health		
Total parity	Number of biological children: one child; two children; three or more children	All
Fetal loss	Between Year 1 and Year 3 pregnancy ended in abortion or miscarriage	Year 3
Currently pregnant	Yes; no	Year 3
Perinatal behavioral health		
Generalized anxiety disorder	Yes; no (defined in Table 3.1)	Year 1
Major depressive episode	Yes; no (defined in Table 3.1)	Year 1
Binge drinking	Any 5+ drinks in one occasion (yes; no) in the past month	Year 1
Marijuana use	Any (yes; no) in the past month	Year 1
Hard drug use	Any use of sedatives, tranquilizers, amphetamines, analgesics, inhalants, cocaine, LSD, and/or heroin (yes; no) in the past month	Year 1
Cigarette smoking while pregnant with focal child	Yes; no	Year 1
Health limitations		
Functional limitations due to health	"Do you have a physical or mental health condition that limits the work you can do?" (yes; no)	All

ANALYTIC METHODS

Data cleaning and exploratory analyses were conducted before model building began. For each survey wave, primary outcomes, predictors and potential covariates were examined. Each variable was assessed based on its form and use in the study (e.g., continuous vs. categorical, scoring of sub-scales, etc.). Descriptive (e.g., means, standard deviations, ranges) and correlational (e.g., Chi-square tests and simple regressions) statistics were used to understand the bivariate relationships of the variables at each time point and to identify and make decisions about handling data outliers. In addition, before models were fit, multicollinearity was assessed using variance inflation factors and variables were dropped or combined as necessary.

Handling missing data. Missing data is a concern, especially in longitudinal contexts, due to study drop-out and loss-to-follow-up. In addition to sample attrition over time, there was also item-level missingness in this study (see Table 2.5). Data exploration was used to determine if data were missing: 1) completely at random, 2) at random due to a process that could be measured, or 3) missing not at random due to an unmeasurable process. To address missing data, one option is listwise deletion, in which cases with any missing information are dropped from the analyses. This approach risks biasing the analytic sample, reduces sample size, and thus power and precision of model estimates. Modern missing data methods are important tools to reduce biases due to missing data. In this study, missing data were imputed with multiply imputed chained equations (MICE) in a sequential fashion.[74,75] For example, for Aim 3, missingness of the outcome variable (Year 3 behavioral health care use) was related to two cities not receiving that question due to survey administration issues. For that MICE model, the outcome variable

was first imputed using an auxiliary variable (i.e., city flag), and then an imputation model was added to the previous model to include the other predictors of interest.[74–76]

We assumed that data were missing at random (MAR) such that other variables in the dataset were not related to patterns of missingness.[75] Lastly, to validate the MICE process, we compared model estimates from complete case and imputed datasets and found inferences to be comparable.

Table 2.5 Item-Level Missingness across Study Aims: Year 3 Sample (*N*=4205)

Variable	N	%	Function in Study
Year 5 major depressive episode	387	9.2	Aim 2 outcome
Year 3 behavioral health symptom profiles	0	0.0	Aim 1 outcome, Aims 2 & 3 primary predictor
Maternal age	0	0.0	Correlate for all
Race/ethnicity	11	0.3	Aim 3 moderator; correlate Aim 1 & 2
Maternal education	5	0.1	Correlate for all
Year 5 household poverty	378	9.0	Correlate for Aim 2
Year 5 relationship status	9	0.2	Correlate for all Aim 2
Year 5 employment	386	9.2	Correlate for Aim 2
Year 5 parity	384	9.1	Correlate for Aim 2
Year 5 fetal loss	384	9.1	Correlate for Aim 2
Year 1 health limitation	222	5.3	Correlate for all
Year 3 health limitation	11	0.3	Correlate for all
Year 5 health limitation	389	9.3	Correlate for Aim 2
Year 1 major depressive episode	218	5.2	Correlate for all
Year 1 generalized anxiety disorder	222	5.3	Correlate for all
Year 1 binge drinking	227	5.4	Correlate for all
Year 1 marijuana use	219	5.2	Correlate for all
Year 1 hard drug use	218	5.2	Correlate for all
Year 1 smoked cigarettes in pregnancy	10	0.2	Correlate for all
Year 3 instrumental support	129	3.1	Aim 2 moderator; correlate Aim 3
Year 3 behavioral health care use	610	14.5	Aim 3 outcome

Aim 1 Statistical Analysis Plan

Aim 1: To describe maternal behavioral health profiles based on symptoms characteristic of multiple psychiatric disorders.

Hypothesis 1.1: Symptoms characteristic of four probable disorders (depression, anxiety, alcohol dependence, and drug dependence), can be analyzed to identify meaningful person-based maternal behavioral health symptom profiles.

Hypothesis 1.2: Mothers in symptomatic profiles will be disproportionately more likely to be low-income, single, and to report a history of perinatal behavioral health risk than those in the symptom-free profile.

To describe subgroups of mothers based on their symptoms (**Hypothesis 1.1)**, latent class analysis (LCA) was employed using 33 behavioral health symptoms (Table 3.1). LCA is a person-based analytic method that describes unobserved latent constructs based on observed variables (Figure 3.1).[77] LCA estimates both sample class proportions (i.e., the estimated sample size of each class or profile) as well as item-response probabilities (range: 0-1), which indicate how likely it is for a participant, assigned to a given profile, to endorse a given item.[77] LCA begins with a one-class solution model, and then is re-analyzed in an iterative manner, each time increasing the model's number of classes by one. The best fitting model was selected based on relative fit statistics, including the Bayesian information criteria (BIC), Lo-Mendel-Rubin likelihood ratio test (LMR-LRT), and the Akaike information criterion (AIC), and an absolute fit statistic (e.g. entropy values, with values >0.8 indicating excellent subgroup classification),[78,79] as well as theoretical and clinical relevance. In the class enumeration step, each profile was labeled with a meaningful and descriptive name based on subgroup-specific item-response

probabilities.[77] Profiles were further validated by inspecting the distribution of behavioral health risk correlates across profiles and in conversations with experts in behavioral health who are members of my dissertation advisory committee.

Assumptions of latent class analysis. There were several assumptions of LCA that were considered in this study. First, in LCA, classes are assumed to be mutually exclusive with no overlap. To test this assumption statistical tests were used to assess model identification (e.g. are there unique interpretations for the parameters?) and estimability (whether enough data are present to estimate the parameter). The specific tests used and some of their properties are summarized in Table 2.6. Second is the LCA assumption of local independence. This assumption is not about the relationship between the behavioral health symptoms that define the need classes; they are empirically related because they cluster into the defined latent constructs and theoretically related because they reflect types of behavioral health conditions. The important assumption is that independence is assumed locally, such that each latent class is distinct, representing unique information about a group of individuals.[77] And lastly, in LCA, variables should be assumed to be missing at random, or at least "ignorably" missing at random. This was explored in the initial phases of the study analysis.

Table 2.6: Statistical Tests for Assessing Model Fit in LCA[77]

Test statistic	Concept	Evaluation
Bayesian Information Criteria (BIC)	Assesses relative model fit, based on sample size, G^2 and number of parameters estimated	Smaller value indicates better fit
Akaike Information Criterion (AIC)	Assesses relative model fit, based on G^2 and number of parameters estimated	Smaller value indicates better fit
Likelihood ratio statistic (G^2)	Reflects how well model fits the observed data	Larger the G^2, more evidence against the null hypothesis
Entropy	Summary of absolute model fit; certainty of classification of subgroups	Larger values indicate less misclassification with values closer to 1.00 indicating better fit.

After predicting probabilities of class membership (**Hypothesis 1.1**), the association between belonging to a given symptom profile and selected maternal characteristics was estimated with multinomial logistic regression (**Hypothesis 1.2**). First, profile-specific differences in maternal characteristic distributions were explored with Chi-squared tests for categorical variables and t-tests for continuous variables. To identify maternal characteristics associated with membership in each profile, predicted profile assignments were treated as a manifest dependent variable, and their correlates were identified using multinomial logistic regression. Multinomial logistic regression allowed differential predictions of belonging to mutually exclusive behavioral health symptom profiles.[80]

Aim 2 Statistical Analysis Plan

Aim 2: To predict mothers' risk of a future major depressive episode, based on their behavioral health symptom profile.

Hypothesis 2.1: Various maternal behavioral health profiles will differentially predict future MDE risk; women in more severe profiles will have the highest probabilities of future risk.

Hypothesis 2.1: Adjusting for covariates and for each profile, mothers reporting some (versus low) instrumental social support will have a lower probability of MDE.

To test the hypotheses associated with Aim 2, we first examined how maternal characteristics varied by Year 5 probable MDE, using Chi-square and t-tests. Second, we examined a multivariable logistic regression model to estimate the association between Year 3 maternal behavioral symptom profiles and Year 5 MDE, adjusting for maternal characteristics (**Hypothesis 2.1)**. Finally, we conducted a moderation analysis to examine if the association between Year 3 maternal behavioral health profiles and Year 5 MDE varied by instrumental social support (**Hypothesis 2.2;** Figure 4.1). To assist with interpretation and comparisons among behavioral health profiles, we estimated predicted probabilities (using Stata's *margins* command), which yields the profile-specific probability of future MDE for each symptom profile, assuming a distribution of correlates consistent with the population average.[81]

Assumptions related to logistic regression. While logistic regression makes fewer assumptions about normality of variable distributions than linear regression, there are several assumptions that were important to keep in mind. First, the outcome variable in a logistic regression model

must be either binary or ordinal; the analyses in Aim 2 tested a binary outcome of MDE (yes=1; no=0). Second, observations should be independent of each other (i.e., not clustered) and with minimal correlation among variables. These assumptions were tested with fit statistics (e.g., using Stata's goodness of fit statistic, *lfit*) as well as with variance inflation factors.[82] When we detected too much collinearity among variables (e.g., between mothers' self-report of her "overall health" and functional limitations due to health), we made the decision to drop one of the correlated variables. And lastly, models should include as many explanatory variables (i.e., predictors) as necessary to predict an outcome, in the most parsimonious way possible. Correlates of MDE were selected based on the literature (see **Chapter one** and chapters corresponding to individual aims) and in conversations with dissertation advisory committee members.

Aim 3 Statistical Analysis Plan

Aim 3: To predict the probability of behavioral health care (BHC) use based on mothers' behavioral health symptom profile.

Hypothesis 3.1: Maternal behavioral health profiles will differentially predict BHC use; women in more severe profiles will have the highest probabilities of BHC use.

Hypothesis 3.2: Having health insurance will increase the probability of BHC use and black and Hispanic women (compared to white women) will be less likely to use BHC, adjusting for covariates.

Hypothesis 3.3: Adjusting for covariates and for each profile, black and Hispanic women (compared to white women) in each symptom profile will be less likely to use BHC.

To examine the hypotheses associated with Aim 3, we first examined how predisposing and enabling factors associated with Year 3 BHC use varied by race/ethnicity with Chi-squared tests. Second, we fit a multivariate logistic regression model to estimate the association between Year 3 behavioral health symptom profiles and Year 3 BHC use, adjusted for covariates (**Hypothesis 3.1**). To assist with interpretation of subgroup-specific probabilities of BHC use, we estimated the predicted probabilities for the primary predictor (i.e., symptom profiles) and moderator (i.e., race/ethnicity; **Hypothesis 3.2**) in each model.[81] Predicted probabilities (using the Stata "margins" command) allowed us to estimate the likelihood that an "average individual" in a specific group (e.g., for a white woman)—if she had average levels of each of the correlates in the model—used BHC.[81] And lastly, we conducted a moderation analysis to estimate the extent to which symptom profile-specific differences in BHC use varied by race (**Hypothesis 3.3**). The assumptions associated with logistic regression modeling were the same as those described in the Aim 2 statistical plan, with a different binary outcome: Year 3 BHC use (yes=1; no=0).

Statistical software. The latent class analyses for Aim 1 were conducted in Mplus 8 (Muthén & Muthén, Los Angeles, CA).[83] All of the regression modeling for Aims 1, 2 and 3, as well as the imputation modeling, were conducted in Stata 14 (Stata Corp, College Station, TX).[84]

Human subjects approval. The Data Archive at the Office of Population Research of Princeton University and the Johns Hopkins IRB approved use of these data, which are publicly available and de-identified (see Appendix A for IRB determination letter from July 12, 2016).

CHAPTER THREE

Maternal Behavioral Health Symptom Profiles in Early Family Life:

Complexity and Context

ABSTRACT

Purpose: Mental health and substance use problems affect 15 to 20% of U.S. mothers in the perinatal and early parenting periods, but few studies have examined how these problems cluster within a given mother's experience. Characterizing mothers' symptom profiles and their correlates early in the family life cycle may provide a more comprehensive approach to characterizing mothers' behavioral health, ultimately guiding efforts to address their needs and improving their and their family's health and functioning.

Methods: Data from the Fragile Families and Child Wellbeing study, a national birth cohort of low to moderate income, mostly unmarried mothers (*N*=4,205), provided self-reports of depression, anxiety, and substance dependence symptoms. Latent class analysis (LCA) identified mothers' behavioral symptom profiles in their children's 3rd year of life (i.e., Year 3). Associations between Year 3 symptom profiles and demographics, reproductive history, functional health limitations, and perinatal behavioral health were explored.

Results: LCA identified 5 profiles: 1) Depression only (14.5% of sample), 2) Severe depression and anxiety (5.3%), 3) Anxiety only (2.2%), 4) Depression and substance use (1.4%), and 5) Currently symptom free (76.6%). After adjustment, perinatal behavioral health problems were the most robust correlates of being in a symptomatic profile in Year 3. Women who reported health-related functional limitations and experienced relationship dissolution had increased odds of endorsing the "Severe depression and anxiety" profile. Women with higher parity and health-related limitations had higher odds of endorsing the "Depression only" profile.

Conclusions: A quarter of mothers of young children had clinically significant behavioral health symptoms. Perinatal behavioral health risks (i.e., postpartum depression and anxiety; smoking in pregnancy) were associated with elevated risk for all four symptomatic

profiles, warranting critical attention by obstetricians, prenatal clinic managers, and pediatricians.

INTRODUCTION

Behavioral health symptoms in mothers of young children, including depression, anxiety, and drug and alcohol dependence problems, have been well-studied as predictors of negative maternal and child outcomes. For women, these symptoms elevate risk for suicide,[15] relationship problems,[16] loss of work, and future chronic illnesses.[61] For children, these problems increase risk for preterm birth,[6] the development of internalizing and externalizing mental health problems, poor school outcomes,[17,18] and inadequate preventive health care,[19] and can be disruptive to the entire family system.[23] Women's behavioral health symptoms have also been related to difficult transitions to parenthood,[59] increased risk for pregnancy or obstetrical complications,[33,34] and disproportionately more comorbid physical health conditions.[61] Although pregnancy can increase risk for anxiety and depression,[15] some women may reduce alcohol[32] and drug use.[64]

Infancy and early childhood (i.e., birth to age 3) are characterized by children's quickly changing developmental needs and mothers' competing demands of work and/or managing households and child rearing.[20,21] Positive parenting trajectories that include responsive caregiving and routine-setting are established early,[7] and have immense potential to influence healthy child development.[22] Untreated maternal depression can negatively affect both parenting practices and child development during this sensitive period.[85] Factors (such as inadequate social support) known to be associated with behavioral health symptoms are potentially modifiable, and evidence from interventions with young mothers with depression demonstrate the potential for intervention.[85] Understanding how behavioral health conditions during the perinatal period are

associated with subsequent patterns of behavioral health symptoms when children are 2-3 years old underscores the urgency of a lifecourse orientation to policy and medical services planning.

Compared to married mothers, unmarried mothers are particularly at risk for economic adversity, relationship instability, and a range of other psychosocial factors associated with higher psychological distress.[39–41] Prior studies have demonstrated that these families (i.e., "fragile families") have higher than average behavioral health risk,[41] making them an important focus for health promotion and prevention policy and research.

Maternal behavioral health research commonly focuses symptoms charateristc of single disorders, measured to resemble the symptom criteria needed for a DSM/ICD diagnosis.[37] This approach can limit the preventive relevance of research given that symptoms themselves may indicate the prodromal stage of one or more psychiatric disorders and can cause impairment in functioning even below diagnostic thresholds. The Research Domain Criteria Initiative (RDoC) is one attempt to respond to these limitations, providing a new approach for studying the psychobiological systems underlying functioning. The RDoC describes domains of functioning by integrating multiple levels of information, from self-report to biological measures and describing severity dimensionally, based on impairment. This better mirrors the phenomenology of behavioral health problems, since many people experience symptoms characteristic of multiple types of disorders.[37,38] However, this cross-disorder approach has rarely been applied in population-level cohort studies.

Moreover, most studies of women's behavioral health have focused on symptoms characteristic of a single disorder, defined categorically, such as depression[29–31] or a narrowly defined behavior, such as alcohol use.[32] In particular, there is limited evidence related to the natural course of anxiety disorders among perinatal women.[35,36] Although conducted with clinical samples, a notable exception to the disorder focus is the Postpartum Depression: Action Towards Causes and Treatment (PACT) Consortium study, which included symptom-level data to describe phenotypes of perinatal depression and anxiety in a large international sample.[33,34] A population-based study based on Pregnancy Risk Assessment Monitoring System data from two states showed significant overlap between depressive and anxiety symptoms in the first four months postpartum.[14] To our knowledge, no study has included mothers' mood disorder and alcohol and drug dependence symptoms to identify broad behavioral health phenotypes in a non-clinical population.

Acknowledging that depression is now understood to be the most common risk factor for serious pregnancy and birth complications,[6] the American College of Obstetricians and Gynecologists (ACOG) recommends that screening for depression and anxiety take place at least once in the perinatal period,[24] and that treatment resources be available for women who screen positive. Yetscreening is far from routine, and, even when women are screened, referral, follow-up, and mental health treatment rates among perinatal women are low.[1,27] Multiple explanations have been offered for the poor management of these conditions in prenatal care. Inadequate knowledge about behavioral health problems among many obstetric providers is a contributing factor.[86] Identifying which predictors elevate risk for maternal behavioral health symptoms during the perinatal period (pregnancy through the first 12 months postpartum) and early

parenting years can guide and motivate efforts by obstetricians and gynecologists and medical systems to screen, and ensure adequate treatment, for these problems.

To advance the scientific basis for understanding maternal behavioral health in the perinatal and early parenting periods, this study aims to: 1) characterize subgroups of mothers, based on unique symptom profiles derived from self-reports of a range of diagnostically-relevant depressive, anxiety, alcohol dependence, and drug dependence symptoms during their child's 3rd year and 2) identify maternal characteristics associated with each symptom profile, including demographic, reproductive health, functional health limitations, and perinatal behavioral health problems.

METHODS

This cross-sectional analysis used data from 4,205 mothers in the Year 3 wave of the Fragile Families and Child Wellbeing (FFCW) birth cohort study. Initially, 4,898 families (biological mother, father, and child) were enrolled from 1998-2000 based on randomly selected births sampled from 75 hospitals in 20 U.S. cities with populations larger than 200,000.[87] Unmarried parents were oversampled, such that they comprised three quarters of the sample though only 33% of U.S. mothers were unmarried at that time.[42] The FFCW study collected behavioral health symptom information from mothers in their children's 1st and 3rd years of life, presenting us with an excellent opportunity to study maternal behavioral health risk during the early parenting period, as well as to examine perinatal behavioral health problems associated with that risk.

The Data Archive at the Office of Population Research of Princeton University approved use of these data, which are publicly available and de-identified. The Johns Hopkins School of Public Health IRB determined this study to be exempt.

Behavioral health symptom assessments

Mental health and substance use symptoms were assessed over the phone by trained interviewers using items from four subscales of the Composite International Diagnostic Interview – Short Form (CIDI-SF 1.0),[70] shown to have good validity[71] and reliability[72] in a range of populations.[73] Past year probable major depressive episode and probable generalized anxiety disorder symptom questions were administered in Year 1 and Year 3. Alcohol and drug dependence questions were administered in Year 3. Each behavioral health scale began with screening questions referencing a time frame. Only if the screener question(s) were endorsed were additional symptom questions asked (see Table 3.1 for scales and items). Endorsed symptoms were the basis for identifying behavioral health profiles.

Maternal characteristics associated with behavioral health symptom profiles

Demographic characteristics (Table 3.6) included current maternal age; race/ethnicity; maternal education at baseline, current relationship status with the biological father, and household income as a percentage of the federal poverty line. Reproductive health characteristics included parity, current pregnancy, and recent fetal loss (abortion or miscarriage between Year 1 and Year 3). The health-related functional limitation question, “Do you have a physical or mental health condition that limits the work you can do?” was included in Year 1 and Year 3. Women also reported their overall health rating, but this item was dropped due to collinearity. Perinatal

behavioral health problems included postpartum behavioral health problems (all binary): past 12 month probable Major Depressive Episode (MDE), past 12 month probable Generalized Anxiety Disorder (GAD), and any past month occurrence of binge drinking (5+ drinks in one occasion), any past month hard drug use, any past month marijuana use and cigarette use in pregnancy.

Statistical analyses

Latent class analysis (LCA) was used to characterize behavioral health profiles based on 33 behavioral health symptoms (Figure 3.1). LCA is a person-based analytic method that describes unobserved latent constructs based on observed variables.[77] LCA estimates both sample class proportions (i.e., the estimated sample size of each class or profile) as well as item-response probabilities (range: 0-1), which indicate how likely it is for a participant, assigned to a given profile, to endorse a given item.[77] LCA began with a one-class solution model, and then was re-analyzed in an iterative manner, each time increasing the model's number of classes by one. The latent classes are mutually exclusive and exhaustive, assigning all sample members to a unique class. The best fitting model was selected based on relative fit statistics, including the Bayesian information criteria (BIC), Lo-Mendel-Rubin likelihood ratio test (LMR-LRT), and the Akaike information criterion (AIC), and an absolute fit statistic (e.g., entropy values, with values >0.8 indicating excellent subgroup classification),[78,79] as well as theoretical and clinical relevance. In the class enumeration step, each profile was labeled with a meaningful and descriptive name, based on subgroup-specific item-response probabilities.[77] Profiles were further validated by inspecting the intersection of the distribution of CIDI-SF probable disorder profiles across symptom profiles.

Because of the potential to lose an additional 8% of the sample size due to listwise deletion, data multiply imputed with chained equations (MICE),[74] using 15 imputed datasets, the Year 3 symptom profile dependent variable, as well as all of the aforementioned maternal characteristics from Years 1 and 3. We assumed that data were missing at random (MAR) such that other variables in the dataset were not related to patterns of missingness.[75] To validate the MICE process, we compared model estimates from complete case and imputed datasets and found inferences to be generally comparable.

Profile-specific differences in maternal characteristic distributions were explored with Chi-squared tests for categorical variables and t-tests for continuous variables. To identify maternal characteristics associated with membership in each profile, predicted profile assignments were treated as a manifest dependent variable (dummy-coded), and their correlates were identified using multinomial logistic regression. Multinomial logistic regression allowed differential predictions of belonging to mutually exclusive behavioral health symptom profiles.[80] The LCA was conducted in Mplus 8 (Muthén & Muthén, Los Angeles, CA)[83] and imputation and regression modeling were conducted in Stata 14 (Stata Corp, College Station, TX).[84]

RESULTS

Year 3 sample description

When the focal child was three years old, 4,205 FFCW mothers were available, representing 14% (n=693) attrition from baseline. Reasons for missingness included: maternal death (1.3%, n=9), child death (6.1%, n=42), child no longer in either parent's custody (7.9%, n=55), refused participation (25.1%, n=174) or lost to follow-up (59.6%, n=413). Statistically

significant differences for the Year 3 sample compared to baseline were: race/ethnicity (fewer Hispanics, $p < 0.001$); household income (fewer participants with household incomes <50% below the federal poverty line, $p = 0.001$); and relationship status (more married mothers remained, $p < 0.001$), indicating a slightly more advantaged Year 3 sample.

Mothers identified as non-Hispanic black (48%), Hispanic (26%), or non-Hispanic white (26%); 42% reported household incomes below the federal poverty line. At baseline, 25% were married; 87% were romantically involved with the focal child's biological father. By Year 3, only 52.2% of the biological parents were still together, married or otherwise. At enrollment, 38.5% were first-time mothers. In Year 3 mothers had an average of 2.1 children (*SD*: 1.3; range: 1-13), 6.7% were currently pregnant, and 11.7% had experienced a fetal loss. Also, at Year 3, 8.5% of mothers reported a functional limitation, a physical and/or mental health condition that limited the work they could do.

Table 3.2 presents frequencies of mothers' Year 3 behavioral health symptoms. Having trouble falling asleep was the most common symptom (20.8%), followed by having lower energy than normal (19.7%) and dysphoria, i.e., feeling depressed or down on most days for at least a two-week period (16.7%). Anxiety, alcohol, and drug use items were less frequently endorsed, although 9% endorsed binge drinking.

Behavioral health profile descriptions and validation

Table 3.3 presents LCA fit statistics and Table 3.4 presents item-level conditional probabilities (these are also presented pictorially in Figure 3.2). A 5-class LCA model was

selected based on relative and absolute fit indices, as well as theoretical and clinical meaningfulness (AIC=23414.9; BIC=24487.0; entropy=0.998). Based on the LMR, the 5-class model fit the data better than the 4-class model (-2LL difference=1096.86, degrees of freedom: 34, *p*-value: <0.001), indicating that the 5-class model had good class homogeneity and class separation.[77] Comparisons of LCA symptom profiles and CIDI-SF probable diagnoses demonstrated substantial overlap between the two methods of classification and disorder severity (see Table 3.5).

Currently symptom free. This profile subgroup comprised 76.6% (N=3221) of the sample, having a near-zero probability of endorsing any of the 33 mental health items (prob=0-0.07).

Depression only. This was the largest subgroup of mothers who endorsed items consistent with a symptomatic profile. They comprised 14.5% of the sample (*N*=608), with high probabilities (0.72-1.0) of endorsing 5 of the 7 depression symptoms, and very low probabilities of reporting anxiety (prob all <0.01) and substance dependence symptoms (prob=0-0.09).

Severe depression and anxiety. Mothers in this profile comprised 5.3% of the sample (*N*=233), with high probabilities (prob=0.89-1.0) of reporting low energy, trouble with sleep, concentration problems, feeling down on herself, and dysphoria. They had a moderate probability (prob=0.51) of endorsing thoughts of death, whereas mothers in the "Depression only" subgroup had lower probability (0.35) of endorsing that symptom. These mothers also had high probabilities (prob=0.74-0.91) of endorsing each anxiety symptom.

Anxiety only. Women in this profile made up 2.2% of the sample (*N*=94) and had moderate to high probabilities (prob=0.50-0.76) of endorsing each anxiety symptom. Their probability of reporting depressive, alcohol and drug dependence symptoms was negligible (prob=0-0.12).

Depression and substance use. Mothers in this profile made up 1.4% of the sample (*N*=59) and had moderate probabilities (prob=0.41-0.64) of reporting dysphoria, low energy, trouble falling asleep, and concentration problems as well as moderate probabilities (prob=0.41-0.65) of reporting heavy drinking, marijuana use, hard drug use, and use of both drugs and alcohol "longer than intended." They had low probabilities (<0.01) of endorsing anxiety symptoms.

Maternal characteristics varied by symptom profile (see Table 3.6). Compared to the "Currently symptom free" profile, disproportionately more women with "Severe depression and anxiety" were single and poor or near poor. Women assigned to the "Anxiety only" profile were disproportionately non-Hispanic white, married, and had higher household incomes compared to the overall sample.

Mothers with symptomatic profiles disproportionately were unmarried, with the exception of those in the "Anxiety only" profile. Symptomatic mothers also disproportionately reported a recent fetal loss, compared to women in the "Currently symptom free" profile. Mothers in the "Severe depression and anxiety" profile had the highest proportion of reporting a current health-related functional limitation (24.2%) compared to women in all other profiles. Although mothers in all the symptomatic profiles reported higher proportions of perinatal behavioral health problems, compared to women in the "Currently symptom free" profile, 8.2% of those in the

"Currently symptom free" profile had a probable major depressive episode in the postpartum period and 1.1% had postpartum generalized anxiety disorder. When comparing mothers in different profiles, no statistically significant differences were observed by maternal race/ethnicity, maternal educational attainment, parity or current pregnancy status.

Maternal characteristics associated with behavioral health symptom profiles

Multinomial logistic regression estimated the association of mothers' characteristics to their odds of differentially endorsing symptoms consistent with the four symptomatic profiles. Table 3.7 presents adjusted odds ratios and 95% confidence intervals for each correlate of each symptom profile. Women who reported functional health limitations and experienced relationship dissolution had increased odds of endorsing the "Severe depression and anxiety" profile. Women with higher parity and current functional health had higher odds of endorsing the "Depression only" profile.

Behavioral health problems experienced in the perinatal period were the strongest correlates of belonging to a symptomatic Year 3 profile. Postpartum depression and anxiety and smoking in pregnancy were significantly and independently associated with each symptomatic profile. Postpartum marijuana use was associated with belonging in the "Anxiety only" and "Depression and substance use" profiles. While the associations between postpartum marijuana use and Year 3 behavioral health symptoms were statistically significant, the 95% CI around those estimates were quite wide, likely due to low levels of endorsement of that behavior. And lastly, postpartum binge drinking was associated only with the Year 3 "Depression and substance use" profile.

DISCUSSION

The goal of this study was to describe the complexity of the behavioral health symptom burden among mothers of toddlers based on 33 symptoms that define four relatively common disorders, and to identify maternal characteristics associated with belonging to different symptom profiles. Because unmarried mothers were oversampled in the FFCW, we expected higher than average behavioral health burden in this sample. However, three-quarters of the mothers were free of such symptoms, indicating that the LCA primarily selected those patterns that were most clinically severe, as reflected in the overlap shown in Table 3.5 with diagnosable disorders. Among those with significant symptoms, almost all reported experiencing a significant burden of depressive symptoms: "Depression only" (14.5% of the sample), "Severe depression and anxiety" (5.3%), and "Depression and substance use" (1.4%). Only women assigned to the "Anxiety only" profile (2.2%) did not.

By taking into account symptoms characteristic of multiple types of mental health and substance use disorders, we demonstrated how these symptoms cluster within an individual's experience. For example, in comparing the "Depression and substance use" and "Severe depression and anxiety" profiles, we observed that depressive symptoms were more moderate (i.e., fewer symptoms endorsed and "thoughts of death" less likely to be endorsed) when co-occurring with substance use risk and more severe when co-occurring with anxiety symptoms. Moreover, the highest proportion of mothers endorsing a health-related limitation in activities (24.2%) were those assigned to the "Severe depression and anxiety" profile, compared to all other profiles. This is consistent with prior research regarding the strong association between mental health problems, functional impairment, and physical health.[61,88] Despite clinical wisdom and some

prior research indicating significant overlap of postpartum anxiety and depressive symptoms,[14] mothers in the depression symptom profiles in this sample rarely endorsed anxiety symptoms. These findings add nuance to the current description of behavioral health need among unmarried mothers, which have relied on either counts of mental health problems[41,60] or symptoms characteristic of a single disorder, like MDE.[30,40]

Consistent with prior research, perinatal behavioral health problems increased mothers' risk for being in a symptomatic profile in the future (i.e., in her child's 3rd year). This study contributes to our understanding by taking a life course perspective to a high-risk sample of mothers. The aforementioned PACT study sample, for example, was recruited primarily from psychiatric and obstetrics clinics and provided a picture of a more severely ill population, compared to the present study.

The characterization of maternal characteristics and symptom-level burden associated with "Anxiety only" and "Severe depression and anxiety" profiles adds to the literature on maternal anxiety, which is not nearly as robust as the maternal depression literature.[35,36] Comparing probable CIDI-SF disorder classification to the LCA-generated symptomatic profiles, we observed that the majority of symptomatic women also had probable disorders (Table 3.5); the exception to this was women in the "Anxiety only" profile. For this profile, 43% did not have a probable disorder based on the CIDI-SF classification, perhaps related to the later average onset of a diagnosable Generalized Anxiety Disorder (GAD), which is approximately 35 years old,[36] highlighting the potential value of characterizing symptom burden, especially among young adults.

Although research demonstrates a relationship between mental health and being single,[13,60,89] we found that being single was only associated with the "Severe depression and anxiety" profile, not the other symptom profiles. In a post-hoc analysis of women currently together with the biological father, women with all symptomatic profiles were disproportionately more likely to be with a partner who himself had probable depression and/or anxiety and/or substance use disorder (*results not shown*) compared to mothers in the "Currently symptom free" profile, a finding that merits future study.

Limitations

These findings should be interpreted in light of several limitations. The Year 3 analytic sample reflects 14% missingness from the baseline FFCW sample as described above. Although they may represent a slightly more socioeconomically advantaged population than at baseline, two-thirds of these families are living at or below 200% of the federal poverty level, likely in conditions that place them at high risk for behavioral health problems.[4] All behavioral health symptoms were self-reported and not confirmed by a clinician. And finally, mothers may have under-reported certain symptoms due to social desirability or fear of being reported to child protective services (in particular for drug and alcohol use behaviors), potentially leading to an underestimate of prevalence. Nonetheless, cultural beliefs and values may reduce these mothers' recognition of and willingness to report behavioral health symptoms.[45,90]

Implications for public health research and practice

The complexity and context of behavioral health symptoms among this national sample of mostly low income, unmarried, and racially diverse mothers are important to understand for

behavioral health system planning given that this population is at high risk for inadequate detection and treatment of their behavioral health problems.[3,91] The fact that postpartum mood disorders and smoking in pregnancy were associated with all four symptomatic Year 3 profiles warrants critical attention by obstetricians and prenatal clinic managers who are in a position to provide timely intervention to reduce the likelihood of subsequent problems. Not only are these behavioral health problems likely to persist, recur, and even become more severe, this is a critical life period for maintaining health, healthy romantic and parent-child relationships, and child development.[22] Too little attention has been given to the fact that these disorders are the most common risk factors for serious pregnancy and birth complications.[6] Even beyond women's multiple obstetric visits for one pregnancy, many are likely to see obstetric providers again in a short period of time, as a quarter (25.5%) of these mothers gave birth to an additional child within three years of the focal child's birth and 11% experienced a miscarriage or abortion between the Year 1 and 3 surveys. Additionally, almost all mothers have frequent interactions with pediatricians in the early years of their child's life and primary care pediatrics can play a critical role as well. However, a survey of pediatricians found that only 46% often ask mothers about depression and only 20% ask about parental substance use.[28] Barriers to screening for maternal depression in pediatrics include patient focus (i.e., the patient is the child, not the mother), and similarly to obstetrics, provider training and clinic flow and burden.[92]

The primary contribution of this study is the characterization of maternal behavioral health symptom profiles in a way that more closely aligns with how mothers report they are feeling than the traditional focus on specific disorders, with their differential psychiatric definitions. Further, this study showed that multiple perinatal behavioral health problems put women at risk for such

symptoms during their child's early years. Given the challenges of screening for and managing maternal depression[2,86] it is helpful that this study suggests that although the most problematic profiles are those that involve two types of disorder, both of those involved depressive symptoms. Thus, systematic screening for depression and effective referral and engagement in treatment will identify and help the majority of women with significant problems in this population. More research is needed to characterize the persistence of behavioral health symptom profiles, and to identify malleable factors with potential to disrupt negative health trajectories, including integrating behavioral health services into gynecologic and obstetric care. Such an interdisciplinary approach to maternal mental health and overall well-being is much overdue, given its potential to reduce the incidence, prevalence and cross-generational transmission of mental health and substance use problems.

Table 3.1 Behavioral Health Assessments

Subscale	Screener Question(s)	Additional Symptoms	Probable Diagnosis*
Major Depressive Episode (MDE)	At least a *two-week period* for most of the day and for most days of the week, in the past year: either "felt sad, blue or depressed" (i.e. dysphoria) or "loss of interest in hobbies or work" (i.e. anhedonia)	1. Had lower energy than normal 2. Experienced a weight change +/- 10 pounds 3. Had trouble falling 4. Had sleep or concentration problems 5. Felt down on yourself 6. Had thoughts of death	Defined when a woman endorsed either dysphoria or anhedonia and at least 3 additional symptoms
Generalized Anxiety Disorder (GAD)	For at least a *6-month period* in the past year, on the majority of days: 1) feeling worried or anxious and that the worrying was excessive and 2) lacked control over worries	1. Felt restless 2. Felt eyed-up or on edge 3. Felt easily tired 4. Had trouble keeping your mind on task 5. Was more irritable than usual 6. Had tense or sore muscles 7. Had trouble falling asleep	Defined when a woman endorsed *both* screener questions and at least 3 additional symptoms
Alcohol Dependence (AD)	Had four or more drinks on one occasion *at least once* in the past year and did not report being a "social drinker"	1. Alcohol interfered with work/home life 2. Used alcohol in dangerous situations 3. Had emotional problems from use 4. Had a strong desire to drink 5. Spent a lot of time drinking 6. Drank longer than intended 7. Drank more to get the same effect drinking	Defined when a woman endorsed the screener questions and at least 3 additional symptoms
Drug Dependence (DD)	Used *any* of the following drugs in the past year: marijuana, sedatives, tranquilizers, amphetamines, analgesics, inhalants, cocaine, LSD, and/or heroin	1. Drugs interfered with work/home life 2. Used drugs in dangerous situations 3. Emotional problems from use 4. Had a strong desire to use 5. Spent a lot of time using 6. Used drugs longer than intended 7. Use more drugs to get the same effect	Defined when a woman endorsed the screener questions and at least 3 additional symptoms

***WHO-CIDI:** World Health Organization-Composite International Diagnostic Interview, short form; Year 1 alcohol use included: binge drinking, reporting 5+ drinks in one occasion in the past month; the drug dependence subscale was only administered in Year 3 and referenced past year behavior. Year 1 drug use items were: any marijuana or hard drug use (from the above list) in the past month.

Figure 3.1 Aim 1 Analytic Model

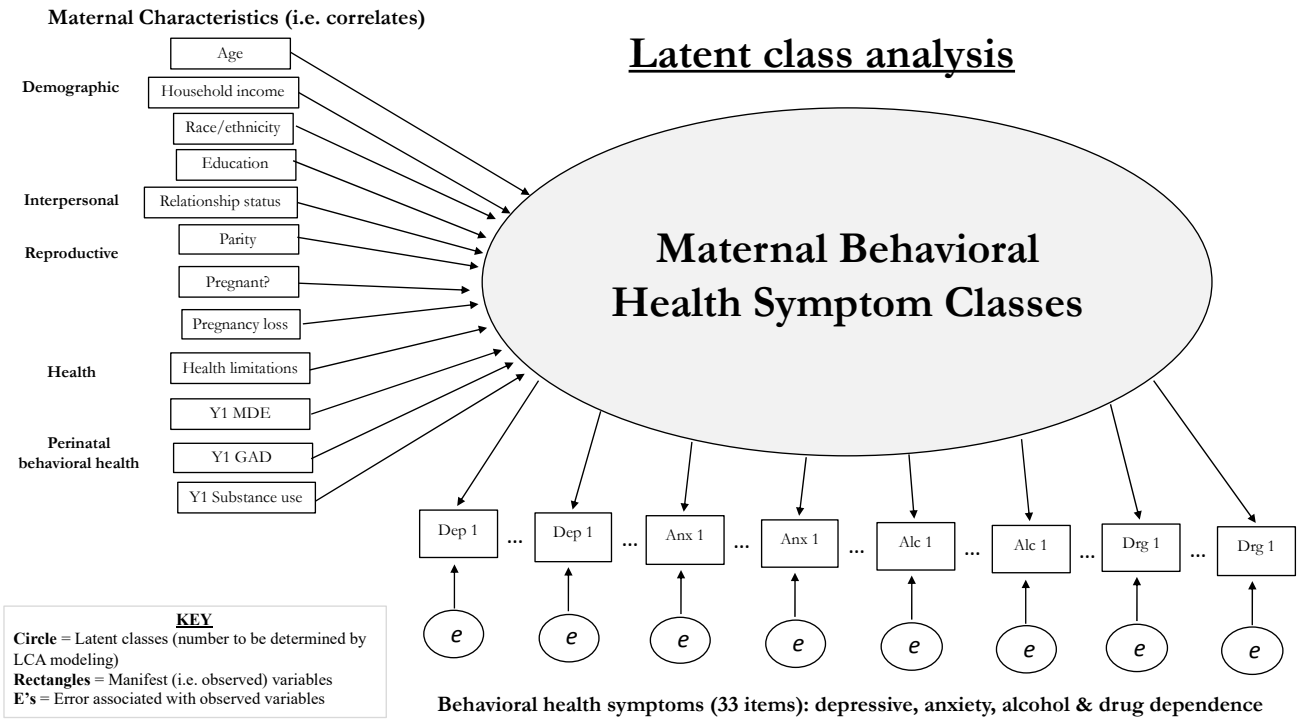


Table 3.2 Year 3 Behavioral Health Symptom Frequencies, *N* = 4205

Symptom	%	*N*
Depression symptoms		
1. Feeling depressed at least two weeks, most days of week, most of each day*	16.7	699
2. Lower energy	19.7	829
3. Weight loss or gain of ≥10 pounds	6.4	269
4. Trouble falling asleep	20.8	873
5. Concentration problems	17.9	754
6. Feeling down on yourself	15.8	664
7. Thoughts about death	8.1	343
Anxiety symptoms		
8. Worried 6+ months, worry was excessive, about 1+ things, majority of days*	5.1	213
9. Lacked control over worries*	6.4	270
10. Restless	6.3	265
11. Keyed-up/on edge	4.9	206
12. Easily tired	6.0	250
13. Trouble keeping mind on task	5.2	219
14. More irritable than usual	6.1	256
15. Tense, sore or aching muscles	5.0	212
16. Trouble falling asleep	6.0	253
Alcohol dependence symptoms		
17. Any 4+ drink days in the past year*	9.0	277
18. Alcohol interferes with work/home	0.7	31
19. Alcohol use in dangerous situations	0.7	28
20. Emotional problems from alcohol use	0.7	30
21. Strong desire to drink	0.6	23
22. Spends a lot of time drinking	0.3	11
23. Longer than intended drinking	3.3	139
24. More time to get the same effect drinking	0.5	20
Drug dependence symptoms		
25. Smoked marijuana/pot on own in the past year*	3.4	143
26. Any hard drug use on own in past year*	4.7	197
27. Drugs interfere with work/home	0.6	27
28. Drug use in dangerous situations	0.3	12
29. Emotional problems from drug use	0.7	29
30. Strong desire to use drugs	0.7	28
31. Spends a lot of time use drugs	0.7	29
32. Longer than intended use of drugs	1.0	42
33. More to get the same effect using drugs	0.8	33

* **Note**: For each disorder, additional symptoms questions asked *only* of women who endorsed the screener question(s); see Table 3.1 for more definition details.

Table 3.3 Latent Class Analysis Fit Statistics

Latent Classes	Parameters	Log likelihood	AIC	BIC	LMR (p)	BLRT (p)	Entropy
1	33	-25699.75	51465.50	51674.86	n/a	n/a	n/a
2	67	-15707.68	31549.36	31974.41	(<.0001)	(<.0001)	0.998
3	101	-12812.96	25827.91	26468.66	(<.0001)	(<.0001)	1.000
4	135	-12086.87	24443.74	25300.18	(<.0001)	(<.0001)	0.999
5	**169**	**-11538.44**	**23414.89**	**24487.03**	**(<.0001)**	**(<.0001)**	**0.998**
6	203	-11272.769	22951.537	24239.375	0.9401	(<.0001)	0.984

Note: Bold indicates best-fitting model based on absolute and relative fit statistics.

Table 3.4 Item-Level Conditional Probabilities by Maternal Behavioral Health Classes, *N*=4205

	Class 1	Class 2	Class 3	Class 4	Class 5
Class Label	**Depression only**	**Severe depression and anxiety**	**Anxiety only**	**Depression and substance use**	**Currently symptom free**
Estimated proportion and class size	14.5 (608)	5.3 (223)	2.2 (94)	1.4 (59)	76.6 (3221)
Depressive Symptoms					
1. Feeling depressed (i.e. dysphoria), at least two weeks, most days of the week, for most of each day*	**0.785**	**0.887**	0.000	**0.407**	0.000
2. Lower energy than normal	**0.955**	**0.968**	0.010	**0.556**	0.000
3. Weight loss or gain of ≥10 pounds	0.276	0.383	0.000	0.285	0.000
4. Trouble falling asleep	**0.997**	**1.000**	0.030	**0.636**	0.001
5. Concentration problems	**0.858**	**0.914**	0.009	**0.556**	0.000
6. Feeling down on yourself	**0.718**	**0.891**	0.000	**0.527**	0.000
7. Thoughts about death	0.348	**0.509**	0.000	0.312	0.000
Anxiety Symptoms					
8. Worried 6+ months, worry was excessive, about 1+ things, and majority of days*	0.000	**0.735**	**0.521**	0.000	0.000
9. Lacked control over worries*	0.000	**0.887**	**0.756**	0.000	0.000
10. Felt restless	0.000	**0.905**	**0.691**	0.000	0.000
11. Felt eyed-up/on edge	0.000	**0.730**	**0.495**	0.000	0.000
12. Easily tired	0.000	**0.846**	**0.660**	0.000	0.000
13. Trouble keeping mind on task	0.000	**0.758**	**0.531**	0.000	0.000
14. More irritable than usual	0.000	**0.855**	**0.709**	0.000	0.000
15. Tense, sore or aching muscles	0.000	**0.740**	**0.499**	0.000	0.000
16. Trouble falling asleep	0.000	**0.838**	**0.691**	0.000	0.000
Alcohol Dependence Symptoms					
17. Any 4+ drink days in the past year*	0.094	0.195	0.114	**0.647**	0.074
18. Alcohol interferes with work/home	0.000	0.023	0.021	0.294	0.002
19. Alcohol use in dangerous situations	0.002	0.013	0.021	0.196	0.003
20. Emotional problems from alcohol use	0.002	0.045	0.021	0.268	0.000
21. Strong desire to drink	0.000	0.022	0.032	0.243	0.000
22. Spends a lot of time drinking	0.000	0.000	0.000	0.162	0.000
23. Longer than intended drinking	0.035	0.108	0.053	**0.597**	0.016
24. More time to get the same effect	0.000	0.013	0.000	0.262	0.000
Drug Dependence Symptoms					
25. Smoked marijuana/pot in past year*	0.028	0.085	0.117	**0.542**	0.020
26. Any hard drug use in past year*	0.070	0.135	0.096	**0.522**	0.026
27. Drugs interfere with work/home	0.005	0.018	0.000	0.258	0.001
28. Drug use in dangerous situations	0.000	0.013	0.000	0.146	0.000
29. Emotional problems from drug use	0.002	0.036	0.000	0.292	0.001
30. Strong desire to use drugs	0.002	0.022	0.011	0.333	0.000
31. Spends a lot of time use drugs	0.002	0.027	0.011	0.327	0.000
32. Longer than intended use of drugs	0.003	0.054	0.000	**0.410**	0.001
33. More to get the same effect using	0.007	0.027	0.000	0.371	0.000

Notes: Item-level probabilities **>0.4 bolded** to assist in interpretation; * indicates screener question for a given subscale; if participant did not endorse screen item(s), no additional symptom questions were asked.

Table 3.5 Comparison of Symptom Profiles Based on LCA and Probable Disorders based on CIDI-SF

	Year 3 Maternal Behavioral Health Symptom Profiles					
	Depression and substance use	**Severe Depression and Anxiety**	**Depression only**	**Anxiety only**	**Currently Symptom Free**	**Total**
Class proportion (*N*)	**1.4 (59)**	**5.3 (223)**	**14.5 (608)**	**2.2 (94)**	**76.6 (3221)**	**4205**
Year 3 Probable Disorder (CIDI-SF criteria)						
Depression						
Major depressive episode (MDE)	62.7	100.0	96.9	3.2	0.0	20.3
Anxiety						
Generalized anxiety disorder (GAD)	0.0	67.7	0.0	39.4	0.0	4.5
Alcohol dependence						
Probable alcohol dependence (AD)	18.6	0.0	0.0	0.0	0.0	0.3
***Any* probable disorder**						
MDE and/or GAD and/or AD and/or DD	83.1	100.0	96.9	42.6	0.03	21.5
Drug use						
Marijuana use	55.9	8.5	2.8	11.7	2.0	3.4
Hard drug use	52.5	13.5	7.2	9.6	2.6	4.7
Alcohol use						
Binge drinking (5+ drinks in one occasion)	54.2	18.8	9.4	10.6	7.3	9.0

Notes: Item-level missingness ranged from 0 to 4.7%; **LCA**= latent class analysis; and **CIDI-SF**= World Health Organization-Composite International Diagnostic Interview, short form.

Table 3.6 Frequency and Between-Group Differences for Correlates of Year 3 Maternal Behavioral Health Symptom Profiles

Class label	Depression only	Severe depression and anxiety	Anxiety only	Depression and substance Use	Currently symptom free	Total	Test statistic[1]
Sample % (*N*)	14.5 (608)	5.3 (223)	2.2 (94)	1.4 (59)	76.6 (3221)	4205	
Maternal age (*M, sd*), [range: 16-50]	27.4 (5.6)	28.2 (5.8)	28.4 (5.8)	27.4 (5.7)	28.4 (6.2)	28.2 (6.1)	*0.038*
15-24 years	41.0	30.5	30.9	40.7	34.0	34.8	*0.009*
25-34 years	45.9	53.4	50.0	47.5	47.8	47.9	
35 years and older	13.2	16.1	19.2	11.9	18.2	17.3	
Race/ethnicity (%)							
Non-Hispanic white	21.1	22.9	28.7	20.3	21.7	21.8	0.066
Non-Hispanic black	54.3	46.2	41.5	61.0	47.0	48.1	
Hispanic	20.9	26.5	24.5	13.6	27.3	26.0	
Other	3.5	4.5	5.3	5.1	3.8	3.8	
Relationship status (%)							
Married	26.5	21.1	34.0	23.7	34.2	32.3	*<0.001*
Cohabitating	18.3	14.8	16.0	10.2	20.4	19.5	
Not cohabitating (but together)	5.4	3.6	8.5	5.1	5.6	5.5	
Another relationship (not focal father)	19.8	25.1	14.9	33.9	17.5	18.4	
Single	30.0	35.4	26.6	27.1	22.4	24.3	
Maternal education (%)							
Less than high school	35.2	41.0	35.1	35.6	32.3	33.2	0.058
Completed high school	31.0	24.8	31.9	40.7	30.7	30.6	
Any post-secondary education	33.8	34.2	33.0	23.7	37.1	36.2	
Household federal poverty line (FPL), %							
Poor/near poor, <100% FPL	48.9	50.7	41.5	52.5	39.8	41.9	*<0.001*
Low income, 100-199% FPL	26.5	22.9	29.8	23.7	24.7	25.0	
Middle or high income, 200%+ FPL	24.7	26.5	28.7	23.7	35.5	33.1	
Currently pregnant (%)	5.16	6.3	7.6	1.7	7.14	6.74	0.218
Recent fetal loss[2] (%)	14.6	15.3	8.5	18.6	10.81	11.7	*0.007*
Parity (%)							
1 child	23.6	25	28.4	27.3	27.5	26.8	0.139
2 children	32.2	34.3	36.4	29.1	35.4	34.8	
3 or more children	44.1	40.7	35.2	43.6	37.1	38.4	
Year 1 Functional limitations (%)	9.9	16.3	12.4	8.9	5.6	7.0	*<0.001*
Year 3 Functional limitations (%)	15.8	24.2	10.6	15.3	5.9	8.5	*<0.001*

Table 3.6 Continued from previous page

Class label	Depression only	Severe depression and anxiety	Anxiety only	Depression and substance Use	Currently symptom free	Total	Test statistic[1]
Perinatal behavioral health (Year 1) (%)							
Major depressive episode	33.4	47.1	30.9	27.1	8.2	14.7	*<0.001*
Generalized anxiety disorder	4.8	18.4	13.8	13.6	1.1	3.0	*<0.001*
Heavy drinking	7.2	10.3	10.6	25.4	5.3	6.3	*<0.001*
Marijuana use	2.5	3.1	4.3	17.0	1.2	1.8	*<0.001*
Hard drug use	0.2	0.5	1.1	3.4	0.2	0.2	*<0.001*
Smoked during pregnancy	25.7	30.5	30.9	52.5	16.3	19.3	*<0.001*

[1] = Overall between-group differences in categorical correlates were analyzed using Chi-square tests; continuous correlates with Bartlett's analysis of variance test
[2] = Recent fetal loss refers to having an abortion or miscarriage between Year 1 and Year 3 follow-up waves.

Table 3.7 Adjusted Odds Ratios (and 95% CIs) of Correlates of Behavioral Health Symptom Profiles, *N*=4205

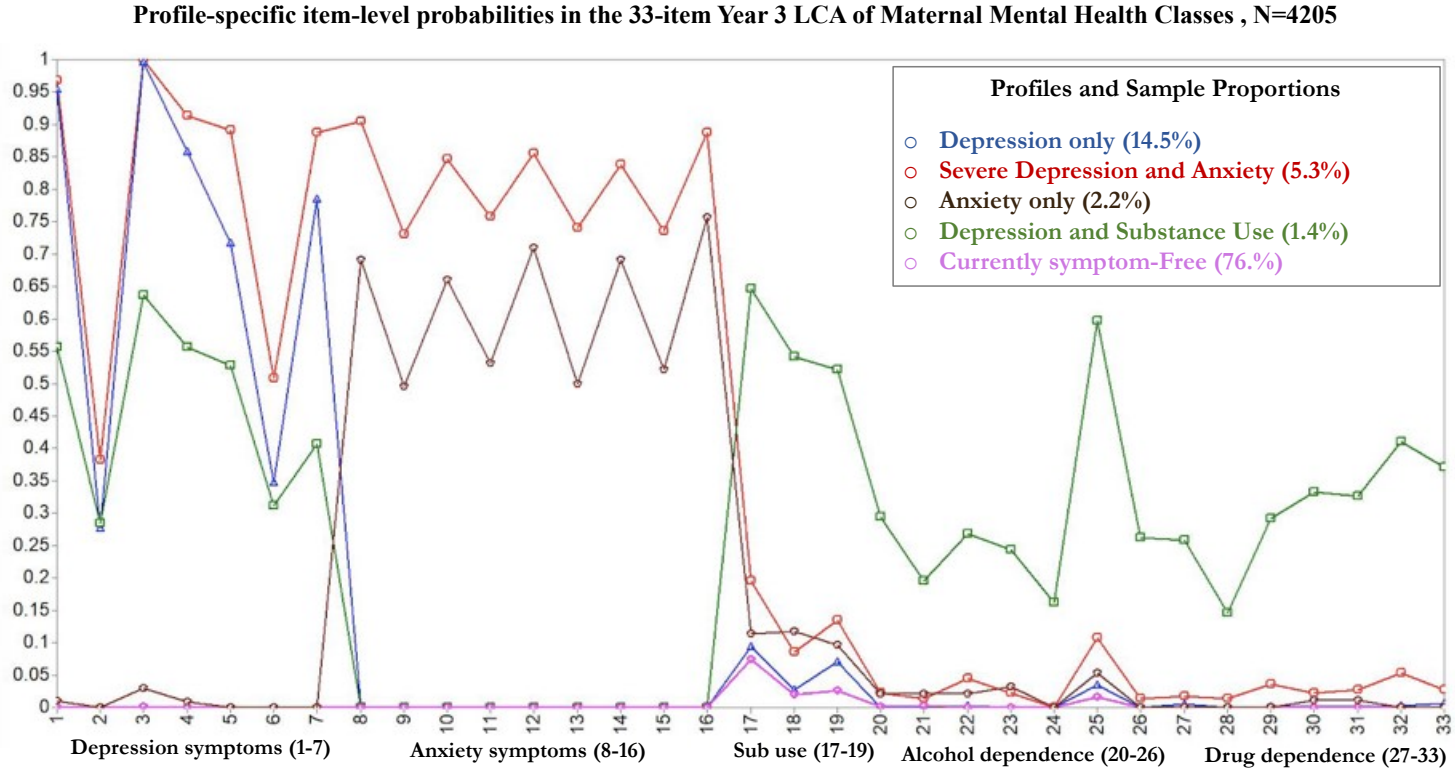
	Depression only		**Severe depression and anxiety**		**Anxiety only**		**Depression and substance use**	
Sample size, % (*N*)	14.5 (608)		5.3 (223)		2.2 (94)		1.4 (59)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Maternal age (*ref:* <25 years)								
25-34 years old	**0.73**	**0.59, 0.91**	1.31	0.91, 1.88	1.22	0.72, 2.08	0.87	0.46, 1.67
35 years and older	**0.50**	**0.36, 0.69**	0.98	0.59, 1.62	1.16	0.57, 2.35	0.55	0.20, 1.48
Race/ethnicity (*ref:* non-Hispanic white)								
Non-Hispanic black	0.96	0.74, 1.24	0.78	0.52, 1.17	0.69	0.39, 1.21	1.46	0.69, 3.11
Hispanic	0.79	0.59, 1.06	1.02	0.65, 1.61	0.77	0.41, 3.57	0.88	0.33, 2.33
Other	1.01	0.59, 1.70	1.26	0.58, 2.77	1.30	0.47, 3.57	2.71	0.70, 10.39
Biological father relationship (*ref:* married)								
Cohabitating	0.87	0.65, 1.17	0.98	0.59, 1.63	0.68	0.35, 1.33	0.40	0.14, 1.12
Together but not cohabitating	0.8	0.51, 1.26	0.80	0.35, 1.86	1.28	0.53, 3.07	0.52	0.13, 2.08
Single (i.e. not in a relationship)	1.19	0.90, 1.57	**2.05**	**1.30, 3.23**	0.98	0.53, 1.81	0.87	0.37, 2.01
Another relationship (not biological father)	0.87	0.64, 1.17	1.73	1.06, 2.80	0.64	0.31, 1.32	1.15	0.50, 2.60
Maternal education (*ref:* <HS)								
Completed high school	1.07	0.85, 1.36	0.72	0.49, 1.05	0.99	0.58, 1.68	1.67	0.87, 3.23
Any post-secondary education	1.27	0.97, 1.65	0.92	0.62, 1.41	0.82	0.44, 1.52	1.14	0.50, 2.60
Household poverty (*ref:* <100% poverty line;								
Low income, 100-199% FPL	0.97	0.77, 1.23	0.93	0.63, 1.36	1.21	0.72, 2.05	0.77	0.38, 1.56
Middle or high income, 200% or more FPL	**0.73**	**0.56. 0.97**	0.99	0.63, 1.53	0.80	0.42, 1.52	0.79	0.35, 1.77
Year 3 Parity (*ref*: 1 child)								
2 children	1.17	0.90, 1.52	1.29	0.82, 2.03	0.94	0.54, 1.65	0.98	0.14, 1.12
3 or more children	**1.38**	**1.06, 1.81**	1.05	0.65, 1.7	0.70	0.37, 1.34	1.03	0.13, 2.08
Currently pregnant	0.67	0.45, 1.01	0.89	0.48, 1.63	1.09	0.49, 2.44	0.15	0.02, 1.14
Recent fetal loss*	1.22	0.93, 1.60	1.15	0.75, 1.78	0.64	0.30, 1.36	1.22	0.58, 2.53
Functional health limitation (*ref*: no)								
Year 1	0.89	0.61, 1.29	1.01	0.56, 1.84	1.34	0.62, 2.90	0.85	0.30, 2.42
Year 3	**2.74**	**2.01, 3.75**	**3.96**	**2.51, 6.23**	1.34	0.61, 2.94	2.16	0.89, 5.22
Perinatal behavioral health risk								
Year 1 Major Depressive Episode(*ref*: no)	**4.74**	**3.80, 5.92**	**6.44**	**4.65, 8.91**	**3.35**	**2.00, 5.60**	**2.29**	**1.17, 4.46**
Year 1 Generalized Anxiety Disorder (*ref*: no)	1.42	0.84, 2.40	**5.02**	**2.94, 8.58**	**5.77**	**2.75, 12.09**	**5.74**	**2.25, 14.68**
Year 1 Binge drinking (*ref*: no)	1.07	0.74, 1.56	1.32	0.79, 2.20	1.50	0.74, 3.01	**3.52**	**1.76, 7.04**
Year 1 Marijuana use (*ref*: no)	1.58	0.84, 2.99	2.12	0.87, 5.13	**2.70**	**0.87, 8.38**	**8.16**	**3.46, 19.26**

Table 3.7 Continued from previous page

	Depression only		Severe depression and anxiety		Anxiety only		Depression and substance use	
Sample size, % (*N*)	14.5 (608)		5.3 (223)		2.2 (94)		1.4 (59)	
	OR	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**	**OR**	**95% CI**
Year 1 Hard drug use (*ref*: no)	0.41	0.05, 3.20	1.04	0.13, 8.29	2.38	0.24, 23.90	4.24	0.61, 29.47
Smoked during pregnancy (*ref*: no)	**1.51**	**1.2, 1.90**	**1.67**	**1.17, 2.38**	**1.91**	**1.51, 3.16**	**4.29**	**2.38, 7.75**

Notes:
OR= Odds Ratio; **CI**= Confidence interval
Bolded OR's and 95% CI indicate<0.05 p-value, i.e. that after adjustment for other covariates, odds of endorsing a given item was statistically significant among mothers assigned to a certain behavioral health symptom profile, compared to the reference "Symptom free" profile.
*****Recent fetal loss refers to having an abortion or miscarriage between Year 1 and Year 3 follow-up waves.

Figure 3.2 Item-Level Predicted Probabilities Associated with Maternal Behavioral Health Symptom Profiles



Mother's mental health and substance use symptoms based on class membership. The Y-axis represents the probabilities of mothers within a given class endorsing a particular item (Mplus restricts this to 0-1). The X-axis represents each of the 33 items.

CHAPTER FOUR

Behavioral Health Symptom Profiles among Mothers of 2-3 Year Olds and Risk of Major Depressive Episode 2 Years Later: The Role of Social Support

ABSTRACT

Objectives: To evaluate the relationship between behavioral health symptom profiles among mothers in their children's 3rd year (Year 3) and risk of major depressive episode (MDE) two years later, in the children's 5th year (Year 5). We also investigated whether risk of future MDE varied by level of instrumental social support.

Methods: In a prior study, latent class analysis described Year 3 behavioral health symptom profiles based on mothers' symptoms of depression, anxiety, alcohol, and drug dependence in the Fragile Families and Child Wellbeing study, a national birth cohort of high-risk mothers (*N*=4205). Multivariate logistic regression was used to evaluate the relationship between membership in Year 3 maternal behavioral health profiles and Year 5 MDE, and included an interaction of profile by social support at Year 5.

Results: Even mothers without symptoms in their children's 3rd year had an 11.1% risk of MDE two years later. Among mothers with clinically significant behavioral symptoms profiles in Year 3, MDE risk was increased an additional 28.6% for those with "Severe depression and anxiety;" by 22.8% for "Depression and substance use;" by 20.5% for "Depression only;" and by 6.0% for those in the "Anxiety only" profile. Overall, instrumental social support slightly decreased the risk for future MDE, and the risk did not differ by behavioral health profile. Relationship status, reproductive health characteristics, and perinatal behavioral health risk all independently predicted future MDE.

Conclusions: Year 3 behavioral health symptom profiles differentially predicted Year 5 MDE risk, suggesting the potential of identifying higher-risk profiles in tailoring surveillance and treatment for mothers of children in the early parenting period. While instrumental support

was associated with decreased future risk in the entire sample, the effect was small and did not vary by symptom profile.

INTRODUCTION

Behavioral health disorders, such as depression and alcohol dependence, affect 10 to 20% of U.S. mothers at any given time, with even more mothers affected by subclinical symptoms, which can also be impairing.[1,10,60] The negative impacts of maternal behavioral health disorders are well-established, including elevated risk for suicide[15] and relationship problems[16] for mothers, and increased rates of preterm birth,[6,93] behavior problems,[17,18] and inadequate preventive health care for children.[19] The early childhood period (i.e., birth to 5 years-old) is a stage in the family life cycle characterized by quickly-changing developmental needs of children and competing demands of work and/or managing households and child rearing.[20,21] While the postpartum period is recognized as a period of increased risk for mood disorders,[34] the early parenting period is also a critical time in children's health and development, which is highly dependent on the extent to which parents engage in responsive caregiving, provide safe physical environments and healthy nutrition, and model other health-promoting practices.[22] When mothers have a significant behavioral health problem, it can disrupt the entire family system and contribute to a negative trajectory for the entire family.[23]

Examining behavioral health problems over time is necessary for understanding the natural course by which they resolve or become more severe, the role of time-varying psychosocial factors, and long-term health effects. Research in this area is especially complex because individual trajectories of behavioral health problems and recovery vary substantially. Investigating maternal behavioral health from a lifecourse perspective by studying these episodes embedded within mothers' reproductive experiences and dynamic child care responsibilities more effectively takes account of the complex contextual demands associated with mothers'

behavioral health outcomes. Indeed, teasing apart the timing and development of behavioral health risk is a high priority of the National Institutes of Mental Health (NIMH), outlined in its strategic plan.[94] Specifically, the plan's second strategic objective is to "chart mental illness trajectories to determine when, where, and how to intervene."[94]

Characterizing health risk over time can inform screening and risk stratification for supportive services for mothers and families at risk for behavioral health problems. Specifically, such findings can inform clinical practice of providers who interface frequently with parents of young children, such as obstetricians, gynecologists, and pediatricians. Professional organizations representing obstetrics and gynecology, pediatrics and public health all recommend screening for maternal depression at least once in the perinatal period.[2,24–26] Despite these guidelines, screening for maternal mental health problems is far from routine, both in the perinatal[1,27] and early parenting perionds.[28] Estimating the maternal behavioral health risks and risk correlates, especially during these sensitive periods for child development, can guide and help instigate greater investment in identification and treatment to reduce the cross-generation impact of maternal behavioral health conditions.

Longitudinal studies demonstrate that there is wide variation in mothers' experience of depressive symptoms by severity and persistence. A latent class analysis of 1,375 mothers from the Study of Early Child Care and Youth Development identified five distinct maternal depression patterns from birth through their child's twelfth year.[95] Roughly half of mothers were never depressed (48%).[95] The other four subgroups included a group with: subclinical symptoms throughout (31%); moderately elevated symptoms throughout (11%); depressive symptoms early

on with decreasing symptoms later (5%); and chronic depression throughout (5%).[95] In comparison, analyses of the Fragile Families and Child Wellbeing (FFCW) study, a birth cohort study of mostly unmarried, low to moderate income mothers from 20 cities across the U.S., found a higher prevalence of major depressive episode (MDE). In the first 9 years of the focal child's life, 31% had intermittent and 7% had persistent MDE.[40] A cross-sectional study of only FFCW mothers in couples (about half of the sample) found that 22% had "any mental disorder" (defined as MDE and/or alcohol misuse and/or illicit drug use) during their child's first year, 30% during the 3rd year, and 27% during the 5th year.[60]

In a prior study, we found considerable heterogeneity in behavioral health symptom profiles among FFCW mothers of children in their 3rd year (i.e., Year 3) (*N*=4205) (Weiss-Laxer, *unpublished data)*. In that study of mothers' 33 depressive, anxiety, alcohol dependence and drug dependence symptoms, latent class analysis (LCA) identified five unique Year 3 symptom profiles: 1) "Currently symptom free" (76.6%), "Depression only" (14.5%), "Severe depression and anxiety" (5.3%), "Anxiety only" (2.2%), and "Depression and substance use" (1.4%). While many studies demonstrate that depression elevates risk for future depressive episodes,[96,97] it is unclear from the current literature if taking into account complex mental health and substance use symptoms will uniquely and differentially predict future depression risk.

Longitudinal studies of maternal behavioral health also have the potential to add to the science about malleable moderators that can attenuate the risk for future mental health disorders. Research from diverse fields (e.g., psychology, sociology and public health), suggests an association between social support and better mental health.[60,98,99] Accordingly, marital status is

often included as a demographic control variable as a proxy for a range of potentially health-promoting mechanisms, including social support. Pilkington and colleagues reviewed maternal mental illness prevention programs involving romantic partners and concluded that emotional support and global support were most consistently associated with fewer depressive symptoms among female partners; other types of support, including effective communication and relationship satisfaction, showed small to moderate effect sizes.[43] They also noted that more research is needed, in particular, to explore the role of social support among single parent-headed households to better inform prevention and treatment efforts.[43] In one such study of FFCW mothers, positive instrumental social support was associated with a decrease in depressive symptoms in the early childhood period.[58]

The FFCW sample comprises mothers who were mostly unmarried at the time of their focal child's birth, making it an important cohort in which to study diverse family structures and behavioral health problem trajectories. Although several studies of FFCW families found that emotional[60] and instrumental social support[58] and relationship quality[100] were associated with lower risks for MDE among married and unmarried couples, these studies did not account for comorbid symptoms such as anxiety or substance misuse symptoms. Thus, prior research may be missing important within- and between-group variations that impact pathways into and out of future illness. Understanding the subgroups of mothers who are most at risk for future depressive disorder can help channel resources to those most in need of intensive and ongoing intervention. Further, accounting for the way in which risk varies by social support might help guide interventions to address this malleable factor to positively influence behavioral health trajectories.

Study aims and hypotheses

The aims of this study were two-fold: First, to estimate the association of behavioral health symptom profiles among mothers in their children's 3rd year (i.e., Year 3) with the risk of major depressive episode (MDE) two years later, in their children's 5th year (i.e., Year 5). Second, to examine whether Year 3 social support moderates the relationship between Year 3 symptom profiles and Year 5 MDE. We hypothesized that Year 3 behavioral health symptom profiles would differentially predict Year 5 MDE. Further, we anticipated that risk of Year 5 MDE would be highest among the "Severe depression and anxiety" profile. In addition, we anticipated that the link between Year 3 behavioral symptom profiles and Year 5 MDE risk would be attenuated by social support.

METHODS

This was a longitudinal analysis beginning with 4,205 mothers enrolled in the Year 3 wave of the FFCW study. Initially, 4,898 families (comprising a biological mother, father and child) were enrolled from 1998-2000 based on randomly selected births.[87] Unmarried parents were oversampled such that three quarters of the sample was unmarried; among U.S. mothers at the time, 33% were unmarried.[42] Mothers were assessed in-person at study enrollment (within days of their child's birth at the hospital) and over the phone at the Year 1, 3 and 5 follow-ups.

Behavioral health measures and timing

In this study, behavioral health measures were based on four subscales of the Composite International Diagnostic Interview – Short Form (CIDI-SF 1.0),[70] shown to have good validity[71] and reliability[72] in a range of populations.[73] These included: past year major depressive episode

(MDE), generalized anxiety disorder (GAD), alcohol dependence (AD) and drug dependence (DD). Each behavioral health scale began with screening questions referencing a time frame, and only if the screener question(s) were endorsed were additional symptom questions asked. Table 4.1 summarizes the behavioral health items, CIDI definitions, as well as their timing and function within the current study.

Dependent variable: Probable MDE was defined as per CIDI-SF guidelines for probable diagnosis in Year 5 (see Table 4.1 for definition).

Primary independent variable: Maternal behavioral health symptom profiles were based on 33 behavioral health symptoms reported in Year 3 and based on the aforementioned latent class analysis study. Symptom profiles were treated as a categorical variable (i.e., dummy coded), and were distributed in this population of mothers as follows: "Currently symptom free" (76.6%), "Depression only" (14.5%), "Severe depression and anxiety" (5.3%), "Anxiety only" (2.2%), and "Depression and substance use" (1.4%).

Maternal characteristics (correlates). *Demographic characteristics* included Year 5 maternal age (<25 years, 25-34 years or 35 years and older); maternal race/ethnicity (non-Hispanic black, non-Hispanic white, Hispanic, non-Hispanic other); maternal education (less than high school, completed high school, or any post-secondary education); Year 5 relationship status with the biological father (married, cohabitating, not cohabitating, with another partner, single) and, Year 5 household percentage of the federal poverty line (FPL; "near poor/poor" if <99% FPL, "low income" if 100-199% FPL, and "middle or high income" if 200% or more FPL). *Reproductive*

health items included Year 5 parity (one, two, three or four + children) and reporting a recent fetal loss (either abortion or miscarriage between Year 3 and Year 5). Year 5 functional health limitation included reporting a "physical or mental health condition that limits the work you can do."

Perinatal behavioral health risk included mental health problems and substance use risk reported in the Year 1 survey. Mental health disorders, based on CIDI-SF definitions, included probable MDE and probable GAD (defined in Table 4.1). Year 1 substance use risk items included: past year binge drinking, past month hard drug use (sedatives, tranquilizers, amphetamines, analgesics, inhalants, cocaine, LSD, and/or heroin), past month marijuana use, and smoking cigarettes while pregnant.

Potential moderator. We investigated whether the association between Year 3 behavioral health symptom profile and Year 5 MDE varied by Year 3 instrumental social support (see Figure 4.1 analytic models). *Instrumental social support* was defined based on the questions, "Do you have someone who can provide you with a) emergency childcare, b) a place to live, and c) a loan for $200?" during the Year 3 survey. This item was dichotomized, with 0="low" (0 or 1 yes) and 1="some" (2-3 yeses).

Statistical analyses

First, we examined how maternal characteristics varied by Year 5 probable MDE, using Chi-square and t-tests. Second, we examined a multivariable logistic regression model to estimate the association between Year 3 symptom profiles and Year 5 MDE, adjusting for the

aforementioned maternal characteristics. Finally, we conducted a moderation analysis to examine if the association between Year 3 maternal behavioral health profiles and Year 5 MDE varied by instrumental social support, including a symptom profile by social support interaction term in that model. For both models, we estimated predicted probabilities (with the margins command in Stata) for the primary predictors.[81] Predicted probabilities estimated profile-specific probabilities of each symptom profile and for social support levels ("low" and "some"), assuming a distribution of correlates consistent with the population average.[81] Missing data were imputed using chained equations (MICE),[74] using 15 imputed datasets. We assumed that data were missing at random (MAR) such that other variables in the dataset were not related to patterns of missingness.[75] To validate the MICE process, we compared model estimates from complete case and imputed datasets and found inferences to be generally comparable. All statistical analyses were conducted in Stata/SE 14.2.[84]

The Data Archive at the Office of Population Research of Princeton University and the Johns Hopkins IRB approved use of these data, which are publicly available and de-identified. The Johns Hopkins IRB determined this study to be exempt.

RESULTS

Bivariate analyses showed that Year 5 MDE risk varied by maternal characteristics, including by race/ethnicity and relationship status (Table 4.2). Disproportionately more women with MDE were poor or near poor, not working regularly, reported a recent fetal loss, had higher parity, current functional health limitations, reported low levels of instrumental social support, and endorsed perinatal (Year 1) behavioral health problems.

As reported in Table 4.3, women in the "Currently symptom free" profile in Year 3 had an 11.1% adjusted risk (i.e., predicted probability; 95% CI: 10.0, 12.4) of Year 5 MDE. Compared to women in the "Currently symptom free" profile, women in symptomatic profiles in Year 3 had even greater risks of MDE in Year 5. Future risk of disorder varied considerably by risk profile, such that the "Severe depression and anxiety" subgroup had the highest risk of future MDE (28.7% more than the women in the "Currently symptom free" profile), followed by "Depression and substance use" (22.8% more), "Depression only" (20.5% more) and the "Anxiety only" profile (6.0% more). Statistically significant between-group differences included: "Anxiety only" vs. "Depression and substance use"; "Severe anxiety and depression" vs. "Anxiety only"; "Severe anxiety and depression" vs. "Depression only"; "Depressed only" vs. "Anxious only"; and, all symptomatic profile comparisons vs. women in the "Currently symptom free" profile.

In the adjusted model, women who reported "some" (compared to "low") instrumental social support in Year 3 had decreased odds of Year 5 MDE (AOR: 0.70, 95% CI: 0.54, 0.93; Table 4.3). In addition, non-Hispanic black and Hispanic women had decreased odds of future MDE, compared to white women. Multiple characteristics were associated with increased odds of

future MDE, including: not cohabitating with a partner, being single (i.e., not in a relationship with the biological father or in a new romantic relationship), reporting a recent fetal loss, having 3 or more children, having functional limitations due to poor health, having probable MDE in the Year 1 survey, and smoking during pregnancy.

Moderation analyses are presented in Table 4.4 (see Table 4.5 for the associated predicted probabilities). In the overall sample, Year 3 instrumental social support decreased the odds of future MDE by about 4 points (p=0.04). However, the within-profile differences (i.e., symptom profile-specific differences between having low vs. some social support) were not statistically significant.

DISCUSSION

We investigated the association between mothers' membership in behavioral health symptom profiles in children's 3rd year and their risk of major depressive disorder 2 years later (Year 5), among a national sample of mostly unmarried mothers. Consistent with other studies, prior behavioral health problems were highly predictive of future psychiatric disorder.[97] Extending the literature, we found that Year 3 maternal behavioral health profiles differentially predicted future Year 5 MDE risk. As expected, co-occurring symptom profiles (e.g., "Severe depression and anxiety" and "Depression and substance use") were associated with the highest predicted probabilities of future MDE. Consistent with other studies, parity[59] was associated with higher risk of future mental health problems. Fetal loss (either miscarriage or abortion) was also related to higher risk for future disorder. Relatedly, in a study of depressive and anxiety phenotypes in the perinatal period, pregnancy and obstetrical complications[33,34] were disproportionately more common among women with more severe phenotypes; fetal loss was not measured in that study.

Women in racial/ethnic minority groups were less likely to report MDE compared to non-Hispanic white women, consistent with some studies[48] but not others.[101] In addition, functional impairment due to poor health was positively associated with MDE risk.

As expected, instrumental social support, among a low-income, unmarried sample of mothers of young children, slightly attenuated future depression risk, affirming what has been shown in previous FFCW studies.[58,100] For mothers who felt that at least one person in their lives could be depended on for emergency childcare, or housing, or a small loan, risk of Year 5 MDE was modestly lower than those who did not feel that way, adjusting for psychiatric history and other maternal characteristics. This indicates that the presence of instrumental social support alone did not dramatically change women's mental health trajectories. The social support effect also did not vary by symptom profile; indicating that perhaps all women could benefit, modestly at least, from efforts to increase instrumental support. It is important to note that maternal relationship status was also significantly associated with Year 5 MDE risk; compared to married couples, less stable relationships (i.e., couples still together but not cohabitating) had the highest odds of MDE, following by women who were single. This emphasizes the importance of relationship stability—possibly a proxy for emotional support—to MDE risk.

These study findings should be considered in light of the following limitations. First, behavioral health symptoms were self-reported and not confirmed by a clinician. Second, only depressive symptoms were reported in the Year 5 survey; thus, we are unable to assess Year 5 risk for anxiety and/or substance dependence symptoms. In addition, our measure of social support was limited to instrumental support; had a more comprehensive assessment of support been available

it would have provided a more robust measure of this experience. And lastly, we were unable to explore the impact of mental health care services receipt on future MDE risk as it was not sufficiently characterized in the FFCW dataset (i.e., information about modality, quality, timing or length of care received was not collected). Additionally, studying mental health care use in descriptive studies presents a dilemma; not only are women who report receiving treatment more likely to have a severe disorder, severe disorders are also more likely to persist and result in continued (although possibly attenuated) symptoms and to require continued treatment, thus obscuring the value that treatment may have had for them and for those with less severe conditions. Given this inherent limitation, understanding the effects of mental health treatment—which ideally shortens disease course[102] and fortifies against future recurrence[53]—on future disorder risk requires more sophisticated research designs (e.g., randomized control trials) or at least measures of severity and thorough descriptions of the type, length and dosage of treatments.

The FFCW is an important sample in which to study trajectories of maternal behavioral health as it is drawn from a non-clinical, national population. Further, the FFCW is composed of a high proportion of low income, unmarried, and racial/ethnic minority women. Given similar contextual factors, racial/ethnic minorities are at reduced risk for behavioral health problems,[103] although once they experience psychiatric disorder they are at increased risk for having more persistent[103] and unmet behavioral health care needs compared to non-Hispanic whites.[3,91]

In contrast to studies that focus solely on depression, considering the contribution of co-occurring anxiety and substance misuse symptoms, as well other maternal characteristics, allowed for more nuanced predictions of MDE risk. Instrumental social support slightly

decreased future MDE risk. Targeted screening and tailored interventions should be considered, in particular, to identify mothers of young children with co-occurring depressive and substance abuse and/or anxiety symptoms, as they are at the highest risk for future disorder. This study makes clear that effective screening, referral and disorder management are also critical during the prenatal and postpartum periods, as postpartum depression and smoking in pregnancy independently elevated risk for maternal MDE in children's 5th year. We also found that experiencing a recent fetal loss, having 3 or more children, and reporting functional impairment due to poor health were all associated with increased risk for MDE. Supporting women as they manage the competing demands of their own mental, physical and reproductive health, along with the needs of their children and families, should be a top priority for health policy and practice.

Figure 4.1 Aim 2 Analytic Models

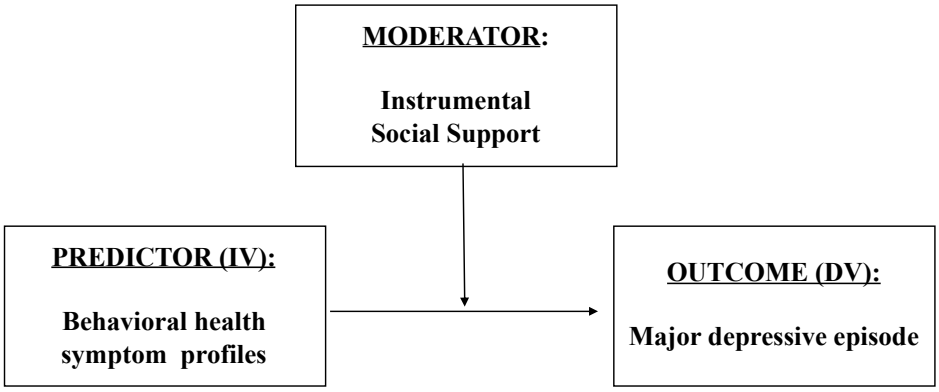
Association for Year 3 behavioral risk profile and Year 5 major depressive episode

Research question: Do Year 3 maternal behavioral health symptom profiles differentially predict Year 5 major depressive episode?

Note: Model is adjusted for maternal characteristics, including: demographic, reproductive health history, health limitations, perinatal behavioral health, and instrumental social support

Moderation by social support

Research question: Does the association between Year 3 maternal behavioral health symptom profiles and Year 5 major depressive disorder vary by instrumental social support?



Note: Model is adjusted for maternal characteristics, including: demographic, reproductive health history, health limitations, and perinatal behavioral health

Table 4.1 Behavioral Health Assessments: WHO-CIDI[1] Items, Probable Diagnosis Definitions, and Function in Current Study

CIDI Subscale	Screener Question(s)	Additional Symptoms	Probable Diagnosis Definition	Study Wave	Function in Current Study
Major Depressive Episode (MDE)	At least a *two-week period* for most of the day and for most days of the week, in the past year: either "felt sad, blue or depressed" (i.e. dysphoria) or "loss of interest in hobbies or work" (i.e. anhedonia)	1) Had lower energy than normal, 2) weight change +/- 10 pounds, 3) trouble falling asleep, 4) concentration problems, 5) felt down on yourself, 6) thoughts of death	MDE defined when a woman endorsed either dysphoria or anhedonia and at least 3 additional symptoms	Years 1, 3 and 5	* Dependent variable: Year 5 MDE (yes/no) * Primary independent variable: symptom list contributed to Year 3 behavioral health symptom profiles * Correlate: Year 1 MDE (yes/no)
Generalized Anxiety Disorder (GAD)	For at least a *6-month period* in the past year, on the majority of days: 1) feeling worried or anxious and that the worrying was excessive and 2) lacked control over worries	1) Restless, 2) keyed-up or on edge, 3) easily tired, 4) trouble keeping your mind on task, 5) more irritable than usual, 6) tense or sore muscles, 7) trouble falling asleep	GAD defined when a woman endorsed *both* screener questions and at least 3 additional symptoms	Years 1 and 3	* Primary independent variable: symptom list contributed to Year 3 symptom profiles * Correlate: Year 1 GAD (yes/no)
Alcohol Dependence (AD)	Had four or more drinks on one occasion *at least once* in the past year and did not report being a "social drinker"	1) Alcohol interfered with work/home life, 2) used in dangerous situations, 3) emotional problems from use, 4) strong desire to drink, 5) spent a lot of time drinking, 6) drank longer than intended, 7) drank more to get same effect	AD defined when a woman endorsed the screener questions and at least 3 additional symptoms	Year 1 (use items only); Year 3 (full scale)	* Primary independent variable: symptom list contributed to Year 3 symptom profiles * Correlate: Year 1 binge drinking (5+ drinks in one occasion in the past month)
Drug Dependence (DD)	Used *any* of the following drugs in the past year: marijuana, sedatives, tranquilizers, amphetamines, analgesics, inhalants, cocaine, LSD, and/or heroin	1) Drugs interfered with work/home life, 2) used in dangerous situations, 3) emotional problems from use, 4) strong desire to use, 5) spent a lot of time using, 6) used drugs longer than intended, 7) took more drugs to get the same effect	DD defined when a woman endorsed the screener questions and at least 3 additional symptoms	Year 1 (use items only); Year 3 (full scale)	* Primary independent variable: symptom list contributed to Year 3 symptom profiles * Correlate: Year 1 any marijuana use or any hard drug use in the past month

[1] = **WHO-CIDI:** World Health Organization Mental Health Composite International Diagnostic Interview

Table 4.2 Maternal Characteristics, by Year 5 Probable Major Depressive Episode, (Complete Case Analysis), *N*=3799

	Year 5 MDE			
	No	**Yes**	**Overall**	**P-value**
Sample size	**3166**	**633**	**3799**	
Sample %	83.2	16.8	100.0	
Year 3 Behavioral health profiles				
Severe Depression and Anxiety	2.9	16.8	5.2	*<0.001*
Depression and Substance Use	1.0	3.4	1.4	
Depression Alone	11.0	33.3	14.8	
Anxiety Alone	2.1	2.8	2.3	
Symptom Free	83.0	43.7	76.4	
Maternal characteristics				
Year 5 maternal age				
15-24 years	17.3	17.1	17.3	0.590
25-34 years	58.8	60.8	59.2	
35 years and older	23.9	22.1	23.6	
Race/ethnicity				
Non-Hispanic white	20.9	25.1	21.6	*0.007*
Non-Hispanic black	48.7	50.7	49.0	
Hispanic	26.8	21.2	25.9	
Other	3.6	3.0	3.5	
Year 5 biological father relationship				
Married	33.1	25.6	31.9	*<0.001*
Cohabitating	13.8	9.2	13.0	
Not cohabitating (together)	3.2	5.2	3.5	
Another relationship (not focal father)	25.5	29.1	26.1	
Single	24.5	30.9	25.5	
Maternal education (baseline)				
Less than high school	32.6	32.9	32.6	0.926
Completed high school	30.9	31.4	31.0	
Any post-secondary education	36.5	35.7	36.4	
Year 5 regular work for pay	61.6	48.2	59.4	*<0.001*
Year 5 household poverty line (FPL)				
Poor/near poor, <100% FPL	38.9	48.5	40.5	*<0.001*
Low income, 100-199% FPL	26.2	24.9	26.0	
Middle or high income, 200%+ FPL	34.9	26.6	33.5	
Year 5 recent fetal loss (%)	9.5	15.9	10.5	*<0.001*
Year 5 parity (%)				
1 child	19.0	15.6	18.4	*0.019*
2 children	35.7	32.8	35.2	
3 children	23.7	25.7	24.0	
4+ children	21.7	26.0	22.4	
Year 5 health limitations (%)	7.5	22.3	10.0	<0.001
Perinatal behavioral health (Year 1)				
Major depressive episode	10.7	38.3	15.3	*<0.001*
Generalized anxiety disorder	1.9	9.1	3.1	*<0.001*
Binge drinking	5.8	9.8	6.5	*<0.001*
Marijuana use	1.7	2.9	1.9	*0.031*
Hard drug use	0.2	0.3	0.3	0.665
Smoked cigarettes in pregnancy	17.4	27.7	19.1	*<0.001*
Year 3 Social support (moderator)				
Low instrumental social support	10.9	21.2	12.6	*<0.001*

Note: *Italics* indicate p<0.05

Table 4.3 Unadjusted and Adjusted Predicted Probabilities (PP) of Year 5 Major Depressive Episode (MDE) by Year 3 Behavioral Health Symptom Profile, *N*=4205

	Unadjusted		Adjusted *	
	PP	**95% CI**	**PP**	**95% CI**
Year 3 symptom profile				
Severe depression and anxiety	53.9	46.6, 61.1	39.7	32.4, 47.0
Depression and substance use	44.5	30.7, 58.3	33.9	21.2, 46.6
Depression only	38.6	34.6, 42.7	31.6	27.9, 35.2
Anxiety only	21.7	13.0, 30.4	17.1	9.8, 24.4
Currently symptom free	9.7	8.6, 10.8	11.1	10.0, 12.4

Notes: Analyses are adjusted for maternal characteristics, including: maternal age, maternal education, household poverty status, relationship status, employment, parity, fetal loss, instrumental support, health limitations, Year 1 depression, Year 1 anxiety, Year 1 binge drinking, Year 1 hard drug use, and smoking in pregnancy.

Statistically significant ($p < 0.05$) between-profile differences in Year 5 probability, adjusted analyses: “Statistically significant between-group differences included: “Anxiety only” vs. “Depression and substance use”; “Severe anxiety and depression” vs. “Anxiety only”; “Severe anxiety and depression” vs. “Depression only”; “Depressed only” vs. “Anxious only”; and, all symptomatic profile comparisons vs. women in the “Currently symptom free” profile.

Table 4.4 Adjusted Odds Ratios of Maternal Characteristics Associated with Year 5 Major Depressive Episode (MDE), *N*=4205

	Year 5 Major depressive episode		
	AOR	**95% CI**	
Year 3 Behavioral health profiles			
Currently symptom free	1.00		
Severe depression and anxiety	**5.81**	**4.08**	**8.29**
Depression and substance use	**4.51**	**2.35**	**8.63**
Depression only	**4.02**	**3.19**	**5.05**
Anxiety only	1.66	0.94	2.95
Maternal age			
15-24 years	1.00		
25-34 years	0.86	0.66	1.13
35 years and older	0.80	0.58	1.12
Race/ethnicity			
Non-Hispanic white	1.00		
Non-Hispanic black	**0.70**	**0.54**	**0.91**
Hispanic	**0.71**	**0.52**	**0.95**
Other	0.68	0.40	1.17
Relationship status			
Married	1.00		
Cohabitating	0.72	0.50	1.04
Together, but not cohabitating	**2.13**	**1.30**	**3.49**
Single	**1.36**	**1.02**	**1.83**
Another relationship	**1.07**	**0.80**	**1.44**
Maternal education			
Less than high school	1.00		
Completed high school	1.18	0.92	1.52
Any post-secondary education	**1.34**	**1.01**	**1.78**
Household % of poverty line			
Poor/near poor, <100%	1.00		
Low income, 100-199%	0.93	0.73	1.19
Middle or high income, 200%+	1.00	0.74	1.34
Recent fetal loss (*ref* = no)	**1.47**	**1.10**	**1.98**
Parity			
1 child	1.00		
2 children	1.25	0.94	1.67
3 children	**1.52**	**1.11**	**2.08**
4+ children	**1.48**	**1.06**	**2.07**
Year 5 health limitation	**2.49**	**1.90**	**3.27**
Postpartum (Year 1) MDE	**2.76**	**2.19**	**3.48**
Postpartum (Year 1) GAD	1.18	0.75	1.85
Postpartum (Year 1) binge drink	1.32	0.93	1.87
Postpartum (Year 1) marijuana use	1.16	0.61	2.20
Postpartum (Year 1) hard drug use	0.69	0.12	4.14
Smoked cigarettes in pregnancy	**1.28**	**1.01**	**1.62**
Has social support (*ref* = low)	**0.70**	**0.54**	**0.93**

AOR = adjusted odds ratio; **CI** = confidence interval; statistically significant correlates p<0.05 are **bolded.**

Table 4.5 Adjusted[1] Odds Ratios of Interaction Between Year 3 Behavioral Health Profiles and Year 3 Instrumental Social Support on Year 5 Major Depressive Episode, *N*=4205

	Year 5 Major Depressive Episode	
	AOR[2]	**95% CI**
Year 3 behavioral health symptom profiles		
Severe depression and anxiety	**5.32**	**2.54, 11.14**
[1]Depression and substance use	1.80	0.47, 6.81
Depression only	**4.04**	**2.42, 6.75**
Anxiety only	1.57	0.43, 5.66
Currently symptom Free (*ref*)		
Overall instrumental social support (SS)[3]		
Low SS (*ref*)		
Some SS	**0.67**	**0.46, 0.98**
Year 3 profile x social support (SS) interactions (*ref* = currently symptom free + low)		
Severe depression and anxiety + some SS	1.12	0.50, 2.51
Depression and substance use + some SS	3.24	0.73, 14.37
Depression only + some SS	0.99	0.56, 1.74
Anxiety only + some SS	1.07	0.26, 4.36

[1] = Analyses are adjusted for maternal characteristics, including: maternal age, maternal education, household poverty status, relationship status, employment, parity, fetal loss, instrumental support, health limitations, Year 1 depression, Year 1 anxiety, Year 1 binge drinking, Year 1 drug use and smoking in pregnancy.

[2] = **AOR** = adjusted odds ratio; **CI** = confidence interval; statistically significant correlates at $p<0.05$ are **bolded**.

[3] = Instrumental social support defined as: "Some" = reported at least two instrumental supports: someone could provide: 1) emergency childcare, 2) a place to live, or 3) a loan for $200; "Low" = reported one or zero instrumental supports.

Table 4.6 Predicted Probabilities (PP)[1] of Year 5 Major Depressive Episode (MDE) with Moderation Analysis of Year 3 Behavioral Health Symptom Profiles by Instrumental Social Support, *N*=4205

	Year 5 Major Depressive Episode			
	Instrumental Social Support[2]			
	Some		**Low**	
	PP	95% CI	PP	95% CI
Overall effect[3]	**16.3**	**15.2, 17.5**	**20.7**	**17.2, 24.1**
Year 3 Symptom profiles				
Severe depression and anxiety	38.2	30.3, 46.1	44.5	30.0, 59.0
Depression and substance use	37.7	22.7, 52.7	23.1	2.2, 43.9
Depression only	30.0	26.0, 34.0	38.2	29.4, 47.4
Anxiety only	44.5	30.0, 59.0	21.1	2.3, 39.8
Currently symptom free	10.7	9.4, 12.0	14.8	10.7, 18.9

Notes:

[1] = Predicted probabilities and contrasts computed with logistic regression model, adjusted for maternal characteristics, including: maternal age, maternal education, household poverty status, relationship status, employment, parity, fetal loss, instrumental support, health limitations, Year 1 depression, Year 1 anxiety, Year 1 binge drinking, Year 1 drug use and smoking in pregnancy. Statistically significant predicted probabilities at $p<0.05$ are **bolded**.

[2] = Instrumental social support defined as: "Some" = reported at least two instrumental supports: someone could provide: 1) emergency childcare, 2) a place to live, or 3) a loan for $200; "Low" = reported one or zero instrumental supports.

[3] = Only the overall within-group contrast was statistically significant; none of the within-profile differences were statistically significant; the association between each Year 3 behavioral health symptom profile and Year 5 MDE risk did *not* vary by level of instrumental social support.

CHAPTER FIVE

Racial Differences in the Association between Behavioral Health Symptom Profiles and Behavioral Health Care Use among Pregnant and Parenting Mothers

ABSTRACT

Objectives: To examine the association between maternal behavioral health symptom profiles and use of behavioral health care (BHC) and variation in this association by race/ethnicity among a diverse, low-income sample of mostly unmarried mothers.

Methods: Data were from the Fragile Families and Child Wellbeing study (*N*=4205 mothers of 2-3-year-old children in 20 U.S. cities), 2001-2003. We estimated the association between each maternal behavioral health profile (subgroups of mothers characterized by their depressive, anxiety, alcohol dependence and drug dependence symptoms) and use of BHC services (past 12 month use of regularly prescribed psychiatric medication and/or counseling) using multivariable logistic regression. We also estimated racial/ethnic subgroup-specific predicted probabilities of BHC use, adjusting for a range of maternal characteristics, including perinatal behavioral health risk.

Results: Mothers with more complex behavioral health profiles (e.g. Severe depression and anxiety vs. Depression only) had the highest predicted probabilities of BHC use. Maternal characteristics associated with higher probabilities of BHC use included older age, functional limitations due to health, perinatal behavioral health risk, and having Medicaid. Adjusting for symptoms, Black and Hispanic women and pregnant women were less likely to report BHC use.

Conclusions: Perinatal behavioral health screening and treatment systems that are culturally acceptable to racial and ethnic minority women are needed to improve women's health during this critical stage in their family's life cycle.

INTRODUCTION

When pregnant and parenting mothers of young children have a significant mental health or substance use problem (i.e., behavioral health problem), it can disrupt the entire family, contributing to negative health trajectories for every family member.[23] Behavioral health problems elevate mothers' risk for suicide [15] and relationship problems,[16] as well as their children's rates of preterm birth,[6,93] internalizing and externalizing symptoms,[17,18] and inadequate preventive health care.[19] These risks are exacerbated for single mothers, who are more likely to live in poverty, and whose children are at increased risk for physical and behavioral health problems, compared to children living in two-parent households.[104] Moreover, given that the overall prevalence of children born to unmarried mothers in the U.S. rose from 5% to 40% between 1960 and 2015,[42] the wellbeing of single parent families is of high societal importance.

Recognizing the importance of perinatal maternal mental health, the American College of Obstetricians and Gynecologists (ACOG) recommends screening for depression and anxiety at least once in the perinatal period.[24] However, unmet need remains high.[27] National estimates indicate that only half of reproductive age women with clinically meaningful depressive symptoms receive a diagnosis.[105] Further, despite seeing medical providers more frequently when they are pregnant, less than half of pregnant women are screened for depression and, among those with mental health need, only 13-15% receive needed treatment.[1] Unmet need is greater among racial and ethnic minority women.[3]

Behavioral health care (BHC) services can lessen the negative impact of behavioral health problems on women and their families by reducing symptoms, improving family functioning and

coping skills[52] and potentially fortifying against future recurrence.[53] The use of BHC may be influenced by individual and interpersonal characteristics, such as having health insurance, beliefs and attitudes about mental health and help-seeking,[46] influences from partners and family,[46,106] and health care system barriers.[1]

Andersen's revised Behavioral Model (ABM) of health care utilization is commonly used to describe the factors that contribute to disparities in BHC use.[55,56] The ABM posits three dynamic tenets of health care services use: predisposing, enabling, and need characteristics.[57] Predisposing factors are characteristics of an individual that exist prior to the onset of health need and influence the likelihood of health care use.[57] Examples include demographic characteristics, health beliefs, social structures, and genetic factors.[57] Andersen describes race/ethnicity as an example of social structure factor related to BHC use.[57] Enabling factors are conditions that make the use of health care services more likely, such as having health insurance and transportation to get to medical appointments.[57] Need refers to both the person's perception of need for care and also evaluated need by a medical provider.

Predisposing factors. The strongest and most consistently demonstrated predisposing characteristic of maternal behavioral need is a prior history of mental health problems.[58] BHC need is also influenced by age of symptoms onset,[34] transition to parenthood, parity,[59] pregnancy and obstetrical complications,[33,34] and physical health.[107] Culturally-held beliefs and attitudes about mental health and acceptable treatment options are also highly relevant to help-seeking behaviors. A review paper of 40 qualitative studies of help-seeking for postpartum depression identified beliefs among women that could be barriers to seeking care; some were unwilling to

disclose symptoms to providers, lacked knowledge about mental illness, feared consequences for their children, assumed their symptoms were a "normal part of motherhood," believed in their ability to cope on their own, did not want to give their family a bad name, and feared having to give up their baby.[46] Similarly, data from the Early Childhood Longitudinal Study—Birth cohort found that, among moderately to severely depressed mothers at 9 months postpartum, minority women and foreign-born women were twice as likely to think they did not need help compared to white, U.S.-born women.[45] Specifically, African American mothers described managing depression by "keeping the faith" or "keeping secrets" and that for some, "depression was a sign of internal weakness and not a legitimate illness" and a "failure of motherhood."[46] In contrast, a study drawn from a clinical population found limited evidence of health belief differences regarding mental health care between women of color and white women who had entered treatment.[47]

Enabling characteristics of BHC use include interpersonal factors such as social support[60] as well as logistical ones such as having health insurance,[57] transportation to get to appointments, a flexible work schedule, and reliable childcare.[46] Pescosolido and colleagues described the influence of an individual's social support system on their mental health care use in presenting the Network Episode Model (NEM).[54] In one study of individuals who sought mental health care, romantic partners and mothers were identified as the most influential members of "health discussion networks"--a support system with whom those individuals discussed health care decision-making.[108] The role that social support network members play may vary by culture. For example, a study of the National Latino and Asian American Survey found that among those with mental health need, Latinos with high family support were more likely to use informal

mental health services, but that effect did not extend to the use of formal mental health services.[106] Families, therefore, may serve as "an alternative source" of mental health care" in some cultural contexts.[106]

Organizational enablers are important as well, including those that either promote or hinder racial/ethnic minority access to care. Some identified organizational enablers include evidence-based and culturally-adapted health care services, increasing providers in predominantly minority areas as well as the availability of linguistically and culturally competent providers.[46,48] One study showed that while referral rates were similar for all ethnic groups, minorities with depression were less likely to follow through with doctor recommendations compared to whites, perhaps signaling a need to improve patient-provider communication.[109]

Healthcare financing policies may also play an important role in enabling BHC use. In the past several decades, Medicaid has become the largest provider of health insurance for both low-income populations as well as individuals with behavioral health problems.[63] Further, Medicaid covers nearly half of perinatal medical care in the US,[62] underscoring the profound impact Medicaid reimbursement policy has on health care for single mothers. And lastly, both the extent to which a person believes they need care, as well as a medical provider's diagnosis of that need (i.e., disorder type, severity and complexity), are likely the most important predictors of health care use.[49,57]

Characterizing need for BHC

Theoretically, the type and severity of the behavioral health problem(s) should largely predict BHC use. In the general U.S. adult population, BHC use does vary by disorder severity but unmet need is high. Analyses from the 2012 National Survey on Drug Use and Health found that 62.9% of those with "serious mental illness" received some treatment, compared to 45.9% with "moderate mental illness," 29% with "low/mild mental illness," and 8.5% with no mental illness.[64] Use of BHC services also varies by disorder type. Individuals with major depressive disorder are most likely to receive care within a year of symptoms onset, and those with substance use disorders are the least likely to receive care.[110] However, delays in care, from onset of symptoms, are common and quite long across all symptomatic groups.[110] Moreover, racial disparities in treatment and quality of care persist, despite increases in health insurance rates.[48]

Characterizing need for behavioral health services is complex as trajectories of illness and recovery vary considerably. Characterizing an individual's "illness career"—their trajectory of substance use and/mental health problem episode(s) coupled with their use (or nonuse) of BHC treatments over time— has been proposed as an valuable way to characterize a person's unmet behavioral health need.[49–51,111] There is wide variability in mental illness careers, foremost determined by the severity and symptom mix of disorder(s), whether or not treatment is sought, and if recovery and/or remission occurs. Women's illness careers are influenced by predisposing factors that can occur proximally in time to the illness episode (e.g., a pregnancy loss) or chronologically more distant, such as the experience of childhood trauma that increase women's vulnerability to behavioral health problems later in life.[49,112]

One approach to studying the extent to which BHC need aligns with the BHC received is "person-level studies" of symptom burden. Compared to "variable-based" studies that quantify relationships among variables, person-based studies aim to identify characteristics of subgroups of a population, based on similar clusters of symptoms exhibited by individuals in different subgroups. Typically, disorders are typically assessed in terms of the symptom criteria needed for a DSM/ICD diagnosis.[37] This focus on disorder status can limit the preventive relevance of research given that symptoms themselves may indicate the earlier stages of a disorder and can cause impairment in functioning even below diagnostic thresholds. Our approach may provide a more complete picture of women's lived experiences of behavioral health problems and may give some indication as to where a person is in her illness career.

In our recent analysis of the Fragile Families and Child Wellbeing study (FFCW), a birth cohort study of mostly unmarried mothers, we employed latent class analysis to identify subgroups of mothers, based on each woman's report of any of 33 depressive, anxiety, alcohol dependence and drug dependence symptoms (Weiss-Laxer, *unpublished data*). When FFCW children were three years old, 4,205 mothers were categorized as belonging to one of the following mutually exclusive and exhaustive profiles: 1) "Currently symptom free" (76.5%), 2) "Depression only" (14.5%), 3) "Severe depression and anxiety" (5.3%), 4) "Anxiety only" (2.2%), and 5) "Depressed with substance use" (1.4%). The extent to which mothers with diverse ethnic and racial backgrounds and with such different profiles of behavioral health need actually access BHC is unknown. Identifying predisposing and enabling characteristics associated with mothers' BHC use, as well as racial differences, will be useful for planning and tailoring health care

screening and treatment services to reduce unmet need for BHC among mothers during a critical stage in their family's life cycle.

Based on these gaps in the literature, this study aimed to answer the following questions:

1) How do distinct person-based maternal behavioral health symptom profiles predict BHC use?

2) Beyond behavioral health symptoms, what significant demographic, predisposing and enabling maternal characteristics are associated with BHC use?

3) Are there racial and ethnic differences in the association between symptom profiles and probability of BHC use, adjusting for demographic, predisposing and enabling maternal characteristics?

METHODS

The FFCW enrolled 4,898 families (comprising a biological mother, father and child) from 1998-2000 based on randomly selected births sampled from 75 hospitals in 20 U.S. cities with populations larger than 200,000.[87] Unmarried families (i.e., "fragile families") were oversampled such that three quarters of the sample was unmarried; overall among U.S. mothers at the time, 33% were unmarried.[42] Mothers were assessed in-person at study enrollment (within days of the child's birth), and over the phone at Year 1 and Year 3.

Inclusion/exclusion criteria: Mothers were included in the analytic sample if they provided behavioral health symptom information at the Year 3 follow-up wave (*N*=4205). The Year 3 survey had a response rate of 85.9%, compared to the originally recruited sample. Reasons for missingness included: death of the mother (1.3%; n=9), death of the child (6.1%; n=42), child

was no longer in custody of either of the study parents (7.9%; n=55), refused to participate (25%), and could not be located or was non-responsive for another reason (59.6%).

Outcome: Women were considered to be users of BHC if they reported in Year 3 that in the past 12 months they regularly took psychiatric medication for either depression or anxiety and/or received counseling or therapy for "personal problems," such as mental health or substance use problems.

Primary predictor of BHC use: Year 3 maternal behavioral health symptom profiles were dummy-coded as "Severe depression and anxiety," "Depression and substance use," "Depression only," "Anxiety only," and "Currently symptom free."

Predisposing characteristics of Year 3 BHC use: These included maternal age (<25 years, 25-34 years or 35 years and older); maternal education (less than high school, completed high school, or any post-secondary education) parity (one, two, or three or more children), a recent fetal loss (pregnancy ended in abortion or miscarriage), and a "physical or mental health condition limits the work you can do" in Year 1 and Year 3. At Year 1, reported perinatal behavioral health symptoms and substance use behaviors were used to identify probable major depressive disorder (MDE), probable generalized anxiety disorder (GAD), and substance use risk. MDE was defined when a woman endorsed either dysphoria ("feeling sad, blue or depressed") or anhedonia ("loss of interest in hobbies or work") on most days for most of the day for at least a two-week period in the past year and the co-occurrence of at least three of the DSM vegetative or mood symptoms. GAD was defined as endorsing *both* 1) feeling worried or anxious for at least a 6-

month period in the past year, that worrying being excessive, and on the majority of days, and 2) lacking control over worries, and endorsing at least 3 additional symptoms. Perinatal (Year 1) substance use risk was identified if the mother endorsed any of the following: past year binge drinking (5 or more drinks in one occasion), past month hard drug use (sedatives, tranquilizers, amphetamines, analgesics, inhalants, cocaine, LSD, and/or heroin), any past month marijuana use, and cigarette smoking while pregnant with the focal child.

Enabling characteristics of Year 3 BHC use: These included current relationship status with the focal father (married, cohabitating, not cohabitating but together romantically, in another relationship not with the focal father, and single), household income as a percentage of the federal poverty line (FPL; "near poor/poor" if <99% FPL, "low income" if 100-199%, and "middle or high income" if 200% + FPL), health insurance coverage (uninsured, Medicaid, and private), and instrumental social support, defined based on the questions, "Do you have someone who can provide you with a) emergency childcare, b) a place to live, and c) a loan for $200?" in the Year 3 survey. This item was dichotomized (0 = "low" with 0 or 1 yes and 1= "some" with 2-3 yeses).

Maternal Race/Ethnicity. Mothers' race and ethnicity was self-reported (white non-Hispanic, black non-Hispanic, Hispanic, and other).

The Data Archive at the Office of Population Research of Princeton University and the Johns Hopkins IRB approved use of these data, which are publicly available and de-identified. The Johns Hopkins IRB determined this to be an exempt study.

Statistical analyses

First, we examined how predisposing and enabling factors associated with Year 3 BHC use varied by race/ethnicity with Chi-squared tests. Second, we examined a series of multivariate logistic regression models to estimate the association between Year 3 symptom profiles and BHC use, adjusted for covariates. From that model, we estimated predicted probabilities (with the margins command in Stata) for the primary predictors in each model.[81] Predicted probabilities estimated profile-specific probabilities of each symptom profile and each ethnic/racial group, assuming a distribution of correlates consistent with the population average.[81] We also fit a moderation model to examine if the relationship between symptom profiles and BHC use varied by race and ethnicity (logistic regression model with a symptom profile by race/ethnicity interaction term) to explore symptom profile differences in BHC use by race and ethnicity.

Missingness of the outcome variable (Year 3 BHC use) was related to two cities not receiving that question due to survey administration issues. The outcome variable was first imputed using an auxiliary variable (i.e., city flag), and then an imputation model was added to the previous model to include the other predictors of interest.[74–76] Missing data were multiply imputed using chained equations (MICE),[74] using 15 imputed datasets, the Year 3 BHC use dependent variable as well the aforementioned maternal characteristics from Years 1 and 3.

We assumed that data were missing at random (MAR) such that other variables in the dataset were not related to patterns of missingness.[75] To validate the MICE process, we compared model estimates from complete case and imputed datasets and found inferences to be comparable. All statistical analyses were conducted in Stata/SE 14.2 (StataCorp, College Station, TX).[84]

RESULTS

Overall, 7.5% of mothers reported any past year BHC use when their children were 3 years old. Of those, roughly half reported counseling/therapy alone (3.5%) and the other half reported regular use of prescribed psychiatric medication alone (1.9%) or in conjunction with counseling (1.3%). Compared to nonusers of BHC, users of care were disproportionately in symptomatic behavioral health symptom profiles (65.0% v. 18.8%, $p<0.001$). Bivariate analyses demonstrated statistically significant differences across most predisposing and enabling characteristics by race/ethnicity (Table 5.1). For example, white women had twice the proportion of BHC use (12.3%) compared to black (6.7%) and Hispanic women (5.7%; $p<0.001$). The percentage of white women in the "Currently symptom free" behavioral health profile was similar to the average (76%), slightly lower for black women (74.9%), and higher for Hispanic women (80.2%, $p=0.02$). Hispanic women had nearly twice the proportion of being uninsured (40.3%) compared to white and black women (19.2% and 18.3%, respectively) ($p<0.001$).

Unadjusted and adjusted predicted probabilities of BHC use varied substantially by behavioral health symptom profile (Table 5.2). Women with depression and symptoms characteristic of a co-occurring condition had the highest predicted probabilities of BHC use. Mothers in the "Depression and substance use" profile had the highest adjusted predicted probability of BHC use (28.7, 95% CI: 17.9, 39.5), followed by "Severe depression and anxiety" (21.1, 95% CI: 15.4, 26.0), "Depression only" (14.4, 95% CI: 11.8, 17.0), "Anxiety only" (12.8, 95% CI: 6.7, 19.0), and "Currently symptom free" profile (5.0, 95% CI: 4.1, 5.9). All between-group comparisons were statistically significant, except for single condition comparisons ("Depression

only" vs. "Anxiety only", p=0.160) and co-occurring condition comparisons ("Depression and substance use" vs. "Severe depression and anxiety," p=0.657).

There were statistically significant racial/ethnic group differences in the predicted probability of BHC use (Table 5.2). Compared to white women, black and Hispanic women had lower overall predicted probabilities of BHC use: 13.3% for white women, 6.6% for black women, 8.6% for Hispanic women, and 5.1% for women who identified as "other" race/ethnicity. The between-group differences between white women and each of the other subgroups were statistically significant.

Adjusted odds ratios (AOR) of BHC use and associated maternal characteristics are presented in Table 5.3. Maternal characteristics associated with increased odds of BHC use included membership in any symptom profile, older age (35 years and older; AOR: 2.4 95% ,CI: 1.5, 3.7), reporting functional limitations due to health (AOR: 3.6, 95% CI: 2.3, 5.7), having a major depressive episode in the postpartum period (i.e. Year 1 survey) (AOR: 1.9, 95% CI: 1.4, 2.7), reporting smoking during pregnancy (AOR: 1.8, 95% CI: 1.3, 2.4), and receiving Medicaid (AOR: 2.0, 95% CI: 1.4, 2.9). Women who were pregnant at the time of the Year 3 survey (i.e. currently pregnant; AOR: 0.5, 95% CI: 0.3, 0.9) were less likely to use BHC. Neither mothers' relationship status or level of instrumental support was significantly related to BHC use.

The moderation analysis examined the extent to which there were racial/ethnic differences in probability of BHC use for each symptom profile individually (Table 5.4). No statistically

significant symptom profile by race interactions were identified, meaning that the association between symptom profile membership and BHC was similar by race.

DISCUSSION

This study demonstrated that person-centered behavioral health symptom profiles differentially predicted use of BHC services among a diverse sample of mostly unmarried mothers of young children. Women with co-occurring behavioral health symptom profiles (depression/substance use and severe depression/anxiety) were more likely to use BHC services compared to women with depressive or anxiety symptoms alone. These findings differ from estimates from the National Comorbidity Study of the U.S. adult population, which found that individuals with MDE were most likely and those with drug dependence were least like to use BHC within a year of disorder onset.[110] However, that analysis did not take into account co-occurring conditions.[110]

Reported use of BHC services was low among this disadvantaged sample of mothers of young children. BHC use in this study was far below the proportion estimated in the 2012 National Survey on Drug Use and Health survey that found that about two-thirds of adults who reported a major depressive episode in the past year received any treatment.[64] On average, white women were more likely to get into services compared to women of color, but we did not find evidence of profile-specific differences by race/ethnicity. Further, pregnant women were disproportionately less likely to use BHC, adjusting for current symptom profile, perinatal behavioral health risk, and other maternal characteristics.

Women in the "Anxiety only" profile were least likely to report using BHC services, consistent with prior studies.[21, 22] These women with anxiety may not have endorsed the psychiatric medication use because they considered their medication use to be for a medical condition, e.g., tense muscles or nervous stomach.[65] Further, mothers with anxiety symptoms may be more able to hide their symptoms from family members, employers, and health care providers compared to those with depression or substance use symptoms, making it less likely for them to be encouraged (or mandated) to seek care.

These study findings should be interpreted in light of the following limitations. First, mothers were only asked about formal behavioral health services, including taking psychiatric medication and/or receiving counseling or therapy. We were not able to assess the extent to which women used informal counseling services, such as those provided by a religious leader or support group. Such women in the FFCW study likely would have answered "no" to the BHC questions.

Despite a large sample with a high representation of minority populations, some of the interactions of symptom profile by race/ethnic categories resulted in small sample sizes that constrained our ability to produce several estimates and may have reduced power to detect true effects in others. A contributing factor may be that in this study, 23.3% were uninsured (compared to roughly 16.5% of the U.S. population at the time),[113] which could partially explain the low use of BHC found in this study. This study cannot be generalized to current health care use levels and is likely an overestimate of unmet behavioral health need; women were surveyed in 2003 and between 2003 and 2016, the uninsured rate dropped roughly 10%, largely due to the Affordable Care Act.[113] However, Alegria and colleagues cogently argue that increases in health

insurance alone will not eliminate racial disparities in BHC use, and that many other strategies are needed to achieve equity.[48] They recommended additional efforts including: diversifying the mental health workforce, adapting evidence-based models of care to specific cultural groups, employing strategies to reach geographic areas lacking a sufficient amount of providers, and adopting models of care that specifically target health disparities alleviation in their program goals.[48]

No questions in the FFCW study related directly to women's decisions to seek help for behavioral health related problems, which are needed to fully understand personal factors related to behavioral health and BHC help-seeking by women with different racial and ethnic backgrounds. In addition, a far greater proportion of Hispanic women were foreign born compared to whites in this sample (38.3% and 4.4%, respectively, $p<0.001$), likely suggesting within-group differences that could differentially impact behavioral health attitudes and help-seeking. And finally, we were unable to assess health care system or health provider-level discrimination, perceived or otherwise, which could also explain some of the racial and ethnic disparities in BHC use that we observed.

Despite these limitations, this study advances the literature by demonstrating how the different combinations of symptoms that women experience are differentially related to BHC use. While mothers with more complex behavioral health needs were the most likely to report using BHC, levels of BHC use were dismally low across the sample and even lower for black and Hispanic women.

In particular, the finding that being pregnant decreased the probability of BHC use among women with significant clinical need is troubling – perhaps our "canary in the coal mine." Over 95% of pregnant women receive prenatal care services in the U.S.,[114] highlighting substantial missed opportunities for identifying and managing these conditions that create significantly elevated risk of poor birth outcomes[6,93] and postpartum depression.[11] Concerted efforts and leadership at the local and national levels are needed to ensure that behavioral health problems are screened as actively as a number of medical conditions that are much less prevalent and often not as pernicious.[2,8] Mothers' mental health problems are readily identifiable in primary care visits[115] and in addition to ACOG, the US Preventive Services Task Force (USPSTF) also recommends that depression screening take place in the pregnancy and postpartum periods, given that "adequate systems are in place to ensure accurate diagnosis, effective treatment, and appropriate follow-up."[26] Often, linkages between obstetric and mental health services are 'on the books' only, so that inadequate identification, poor coordination and long wait times invalidate such 'systems.' An "adequate system" such as the USPSTF envisions could involve integrated primary care and behavioral health services, such as co-location, coordinated or stepped care models.[2,116,117] Ensuring such adequacy requires not only advances in national and state policies, but leadership and effort at the level of health systems, clinical settings and in medical education.

Some suggest expanding coverage of Medicaid through the first entire postpartum year,[118] as most women are dropped from Medicaid within months of delivery.[119] However, this will do little good if women are not routinely identified and helped to engage in effective BHC during the pregnancy or immediate postpartum periods.[8] The effectiveness of such an expensive and

politically challenging policy change would ultimately depend on the knowledge and commitment of obstetric providers, resource investment by health systems, and the availability of culturally acceptable BHC services. According to research with obstetric providers themselves, this workforce requires improved training in the basics of mental health conditions, the value and efficacy of screening and referral, primary care-level management and treatment options.[86,120] Moreover, there is emerging evidence that incorporating routine mental health screening into prenatal and postpartum care, coupled with onsite mental health providers, improves mental health referral uptake.[121]

Success is also contingent on the availability of culturally relevant models of health care services that address the system-level factors contributing to the low level of engagement in mental health services following referral,[27] as well as racial disparities in behavioral health screening, uptake, retention, acceptability, and quality of care. These are major challenges for the obstetrics and mental health care fields, but addressing them well has the potential for vastly improving the mental health and well-being of mothers, children and families in the U.S. across generations.

Figure 5.1 Aim 3 Analytic Model

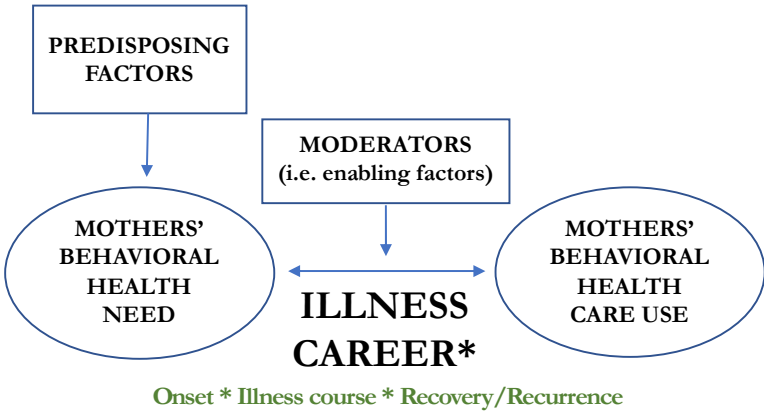


Table 5.1 Correlates of Behavioral Health Care Use and Item-Level Missingness, by Race/Ethnicity (*N*=4194)[1]

	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Total	P-Value
Sample size, N =	918	2021	1095	160	4194	
Year 3 Behavioral Health Profile (%)						
Depression and substance use	1.3	1.8	0.7	1.9	1.4	*0.020*
Severe anxiety and depression	5.6	5.1	5.4	6.3	5.3	
Depression only	13.9	16.3	11.6	13.1	14.5	
Anxiety only	2.9	1.9	2.1	3.1	2.2	
Symptom free	76.3	74.9	80.2	75.6	76.6	
Mental health care use (%)						
Any in past 12 months	12.3	6.7	5.7	3.8	7.5	*<0.001*
Missing	9.8	10.5	21.8	16.3	13.6	
Prior year mental health care use (%)						
None	77.9	82.8	72.5	80.0	78.8	*<0.001*
Counseling/therapy only	4.8	3.6	2.4	1.9	3.5	
Psychiatric medication only	3.8	1.3	1.6	0.6	1.9	
BOTH counseling and medication	2.3	1.2	0.8	0.6	1.3	
Missing	11.2	11.1	22.7	16.9	14.5	
Maternal age (%)						
15-24 years	25.7	38.9	36.5	25.0	34.9	*<0.001*
25-34 years	47.7	47.3	48.7	50.6	47.9	
35 years and older	26.6	13.9	14.8	24.4	17.3	
Maternal education (%)						
Less than high school	18.3	32.4	49.2	20.6	33.2	*<0.001*
Completed high school	24.8	36.5	25.8	19.4	30.5	
Any post-secondary education	56.9	31.0	24.8	59.4	36.2	
Health insurance coverage (%)						
Uninsured	19.2	18.3	40.3	20.6	24.3	*<0.001*
Medicaid	21.1	51.6	31.9	30.0	38.9	
Private	59.3	29.0	26.9	48.1	35.8	

Table 5.1 Continued from previous page

	Non-Hispanic White	Non-Hispanic Black	Hispanic	Other	Total	P-Value
Household income as percentage of the federal poverty line (FPL) (%)						
Near poor/poor (<99% FPL)	19.5	49.3	48.6	30.6	41.9	*<0.001*
Low income (100-199% FPL)	19.9	25.9	27.9	21.3	24.9	
Middle or high income (200%+ FPL)	60.6	24.8	23.6	48.1	33.2	
Parity (%)						
1 child	29.6	22.3	25.8	30.6	25.1	*<0.001*
2 children	38.5	29.6	33.4	32.5	32.7	
3+ children	28.0	41.1	33.7	28.8	35.8	
Recent pregnancy loss (%)	3.9	7.0	7.0	8.1	6.4	*0.005*
Currently pregnant (%)	10.0	13.5	9.7	12.5	11.7	0.719
Year 1 health-related limitations (%)	5.9	7.4	6.3	3.1	6.6	0.108
Year 3 health-related limitations (%)	7.2	10.4	6.3	6.9	8.5	*<0.001*
Major depressive episode (%)	14.3	16.2	12.6	11.9	14.7	*0.037*
Generalized anxiety disorder (%)	3.8	2.8	2.6	3.8	3.0	0.359
Binge drinking (%)	8.9	5.2	6.5	3.1	6.3	*0.001*
Any marijuana use (%)	1.6	2.4	1.0	0.0	1.8	*0.010*
Any hard drug use (%)	0.0	0.3	0.4	0.0	0.2	0.299
Smoked cigarettes in pregnancy (%)	28.3	21.0	9.6	10.6	19.2	*<0.001*
Relationship with biological father (%)						
Married	55.9	17.3	36.1	56.9	32.2	*<0.001*
Cohabitating	13.9	18.7	26.9	10.0	19.5	
Together but not cohabitating	2.6	8.0	3.7	3.1	5.5	
In another relationship	13.0	24.2	13.2	11.9	18.4	
Single	14.4	31.5	20.1	18.1	24.3	
Year 3 low instrumental support (%)	5.5	15.6	13.4	17.1	12.9	*<0.001*

[1] = Tests the null hypothesis that maternal characteristics do not vary by race/ethnicity.

Table 5.2 Overall Unadjusted and Adjusted Predicted Probabilities of Behavioral Health Care Use Associated with Membership in Different Behavioral Health Profiles*

	Probability of Mental Health Care Use			
	Predicted Probabilities (PP)			
	Mental Health Care [1] (Unadjusted)		Mental Health Care (Adjusted) [2]	
	PP	95% CI	PP	95% CI
Behavioral health symptom profile				
Depression and substance use	37.3	24.7, 49.9	28.7	17.9, 39.5
Severe depression and anxiety	33.5	27.1, 40.0	21.1	15.4, 26.0
Depression only	17.9	14.8, 21.0	14.4	11.8, 17.0
Anxiety only	17.4	9.7, 25.2	12.8	6.7, 19.0
Currently symptom free	4.2	3.5, 4.9	5.0	4.1, 5.9
Maternal race/ethnicity				
Non-Hispanic white	13.5	11.4, 15.6	13.3	11.1, 15.5
Non-Hispanic black	7.2	6.1, 8.4	6.6	5.6, 7.6
Hispanic	7.2	5.6, 8.9	8.6	6.7, 10.6
Other	4.5	1.2, 7.8	5.1	1.6, 8.5

Notes:

[1] = Women were considered to use any mental health care if they reported receiving counseling or therapy in the past 12 months and/or regularly taking prescribed psychiatric medication in the past 12 months.

[2] = Predicted probabilities and contrasts computed with logistic regression model, adjusted for maternal characteristics, including: maternal age, race/ethnicity, maternal education, household poverty status, relationship status, employment, health insurance, parity, pregnancy status, fetal loss, instrumental support, health limitations, Year 1 depression, Year 1 anxiety, Year 1 binge drinking, Year 1 drug use and smoking in pregnancy.

* For adjusted models: all between-symptom profile differences were statistically significant, at $p < 0.05$, with the exception of "Depression and substance use" vs. "Severe Depression and anxiety" and "Depression only" vs. "Anxiety only."

* For adjusted model: between-race/ethnic subgroup contrasts that were statistically significant (i.e. $p < 0.05$) include: non-Hispanic white compared to non-Hispanic black women; non-Hispanic white compared to women who self-identified their race/ethnicity as "other;" and, non-Hispanic white compared to Hispanic women.

Table 5.3 Adjusted Odds Ratios (AOR) 95% Confidence Intervals (CI) of Behavioral Health Care (BHC) Use, *N*=4205

	BHC Use		
	AOR	**95% CI**	
Year 3 Behavioral Health Profiles			
Depression and substance use	**10.2**	**5.2**	**19.8**
Severe depression and anxiety	**3.2**	**1.6**	**6.2**
Depression only	**6.1**	**3.9**	**9.6**
Anxiety only	**3.7**	**2.7**	**5.0**
Currently symptom free	1.0		
Maternal age			
15-24 years	1.0		
25-34 years	**1.5**	**1.1**	**2.2**
35 years and older	**2.4**	**1.5**	**3.7**
Race/ethnicity			
Non-Hispanic white	1.0		
Non-Hispanic black	**0.4**	**0.3**	**0.5**
Hispanic	**0.5**	**0.4**	**0.8**
Other	**0.3**	**0.1**	**0.6**
Maternal education			
Less than high school	1.0		
Completed high school	0.7	0.5	1.1
Any post-secondary education	1.2	0.8	1.7
Household income as percentage of the federal poverty line (FPL; %)			
Poor/near poor, <100% FPL	1.0		
Low income, 100-199% FPL	0.9	0.6	1.3
Middle or high income, 200%+ FPL	1.1	0.7	1.8
Worked in the last week	**0.7**	**0.5**	**0.9**
Currently pregnant	**0.5**	**0.3**	**0.9**
Recent fetal loss	1.3	0.8	2.0
Parity			
1 child	1.0		
2 children	1.2	0.7	2.0
3+ children	1.3	0.9	1.9
Year 1 health limitation	0.9	0.5	1.5
Year 3 health limitation	**3.6**	**2.3**	**5.7**
Year 1 MDE	**1.9**	**1.4**	**2.7**
Year 1 GAD	1.7	0.9	2.9
Year 1 binge drinking	1.0	0.6	1.6
Year 1 marijuana use	0.5	0.1	1.7
Year 1 hard drug use	3.2	0.4	24.6
Smoked in pregnancy	**1.8**	**1.3**	**2.4**
Relationship with biological father			
Married	1.0		
Cohabitating	0.9	0.6	1.5
Not cohabitating (together)	1.6	0.9	3.0
Another relationship (not focal father)	1.3	0.8	2.0
Single	1.5	1.0	2.2
Instrumental social support (low)	1.0	0.7	1.5
Health insurance coverage			
Uninsured	1.0		
Medicaid	**2.0**	**1.4**	**2.9**
Private	1.4	0.9	2.3

Table 5.4 Adjusted Odds Ratios and 95% CIs for Behavioral Health Care Use by Symptom Profile by Race/Ethnicity Interaction Terms, *N*=4197

	Mental Health Care Use		
	AOR	95% CI	
Current Behavioral Health Symptom Profiles			
Depression and substance use	**8.9**	**2.4**	**33.1**
Severe depression and anxiety	**7.8**	**3.2**	**19.3**
Depression only	**4.5**	**2.6**	**7.6**
Anxiety only	2.4	0.8	7.3
Currently symptom free	1.0		
Race/ethnicity			
Non-Hispanic white	1.0		
Non-Hispanic black	**0.4**	**0.2**	**0.7**
Hispanic	0.7	0.4	1.1
Other	0.2	0.0	1.1
Symptom profile x race interactions			
Depression and substance use + Black	1.7	0.4	8.2
Depression and substance use + Hispanic		*Not estimable*	
Depression and substance use + Other	1.3	0.0	37.3
Anxious only + Black	1.6	0.4	7.4
Anxious only + Hispanic	1.3	0.2	7.5
Anxious only + Other	4.6	0.2	100.0
Severe anxiety & depression + Black	0.9	0.3	2.4
Severe anxiety & depression + Hispanic	0.5	0.1	1.7
Severe anxiety & depression + Other	0.6	0.0	9.0
Depressed only + Black	0.7	0.3	1.5
Depressed only + Hispanic	0.8	0.3	2.0
Depressed only + Other	1.2	0.1	11.7

Notes:
AOR = adjusted odds ratio; **CI** = confidence interval.
***** Statistically significant correlates at p<0.05 are **bolded**.
***** Analyses are adjusted for maternal characteristics, including: maternal age, maternal education, household poverty status, relationship status, employment, health insurance, parity, pregnancy status, fetal loss, instrumental support, health limitations, Year 1 depression, Year 1 anxiety, Year 1binge drinking, Year 1 drug use and smoking in pregnancy.

CHAPTER SIX

Conclusions and Implications for Policy, Practice, and Research

INTRODUCTION

Mental health problems are common and impairing conditions among adults and are especially problematic in the perinatal period, with at least 20% of women experiencing a serious mental health problem in the pregnancy, postpartum, and early parenting periods.[1,71] Even higher rates are experienced by low-income and unmarried mothers.[4,96] Depression is the most thoroughly researched mental health problem during this life period and is now understood to be the most common risk factor for serious pregnancy and birth complications.[6] However, other mental health and/or substance abuse problems (known collectively as behavioral health problems) can also afflict women during these critical life periods, impairing their functioning and creating risks for the fetus and infant. Although usually studied as unique disorders, behavioral health problems often 'travel together' so that women with one type of behavioral health problem are also a higher risk for other types.

Behavioral health symptoms can be reliably and efficiently detected, even among pregnant women, using standardized assessment tools;[2] moreover, treatments are generally effective, with safe options for pregnant and breast-feeding women.[122] The American College of Obstetricians and Gynecologists (ACOG) recommends that screening for depression and anxiety be carried out at least once in the perinatal period,[24] and that treatment resources be available for women who screen positive. Yet, screening is far from routine, and, even when women are screened, referral, follow-up, and mental health treatment rates among perinatal women are low.[1,27] Multiple reasons have been put forth for the poor management of these conditions in prenatal care. Inadequate knowledge about behavioral health problems among many obstetric providers is a contributing factor.[86] Additionally, the standard disorder-based approaches of psychiatry may be

at odds with the complex picture that many women with these conditions present. They may have symptoms of depression and anxiety, as well as a history of substance misuse. To date, few studies have examined how behavioral health symptoms cluster within a given mother's experience, and how these different symptom clusters relate to risk for future disorder or use of behavioral health services.

This longitudinal study of a racially diverse, mostly low income, and majority unmarried sample of mothers in the U.S. addressed these issues over the period from birth to their child's 5th year. It characterized behavioral health symptom profiles and maternal characteristics in their children's 3rd year of life and estimated the extent to which those symptom profiles were related to behavioral health care (BHC) use during that year by women of different racial/ethnic backgrounds, as well as how membership in a symptom profile differentially predicted future depression in their children's 5th year. Associated maternal characteristics were examined, including demographics, behavioral health problems during the perinatal period, and Year 3 reproductive health status, functional limitations, instrumental social support. This chapter characterizes the gaps in the literature that this study sought to address, summarizes the study's findings, describes its strengths and limitations, and presents implications for public health policy, practice, and research.

CURRENT SCIENTIFIC GAPS IN UNDERSTANDING

The substantial prevalence of behavioral health conditions among pregnant and postpartum women is well established.[35,93,123,124] Most of the literature identifying these problems is focused on symptoms characteristic of single probable psychiatric disorders (i.e., depression, alcohol misuse). However, individuals at risk for behavioral health problems typically have symptoms characteristic of multiple disorders. The ways that young mothers in the general population actually experience such combinations of behavioral health symptoms is unknown. In particular, there are limited non-clinical estimates of anxiety symptoms across the range of these disorders in the perinatal population.[35,36] This study addressed these gaps by demonstrating how depressive, anxiety, alcohol dependence and drug dependence symptoms cluster together at the level of individual mothers by identifying maternal behavioral health symptom profiles.

The extent to which person-based behavioral symptom profiles predict future depression is also unknown, as the majority of population-based studies either focus on a single disorder at a time,[29,93] or assess the point-prevalence of symptom burden.[34] Therefore, this study estimated the extent to which behavioral health profiles, based on symptoms of multiple disorders, differentially predicted future depression risk. We hypothesized that women with symptom profiles characteristic of co-occurring mental health and substance use disorders in their children's 3rd year of life would be more likely to have major depressive episode (MDE) two years later, in their children's 5th year. We also hypothesized that women with high versus low social support would have more positive health trajectories (i.e., that women with high instrumental support would be less likely to report MDE two years later).

Finally, the likelihood that women in different behavioral health symptom profiles would use formal BHC (i.e., psychiatric medication and/or counseling for mental health problems and/or substance misuse) is not known. In addition, this study characterized the probability of BHC use by symptomatic women of different ethnic and racial backgrounds. We hypothesized that mothers with more severe and "observable" symptoms, such women as with depressive symptoms, would be the most likely to report BHC use. Based on the literature, we hypothesized that women of color would be less likely than white women to use BHC, across all behavioral health profiles and adjusting estimates for other maternal characteristics likely to vary by race/ethnicity.

Characterizing maternal behavioral health profiles in a manner that better reflects the presentation of women being treated in obstetrics and other primary care settings may be more consistent with providers' real-world encounters. Using a lifecourse lens to document how the risks that occur during the perinatal period predispose mothers to significant patterns of mental health and substance misuse problems during their child's 3rd year of life, and the extent to which these problems increase future risk for major depressive disorder, may help accelerate efforts to engage perinatal women in timely behavioral health services.[8] This is particularly important for young mothers of color. These efforts may be facilitated by understanding the factors associated with engagement in BHC in order to avoid missed opportunities to address what can become life long and transgenerational disorders with pernicious effects on functioning and well-being.[125] This research has the potential to help guide and foster efforts to create integrated systems of medical, mental health and substance abuse care that can conjointly address women's obstetric and behavioral health treatment needs.

SUMMARY OF FINDINGS

Overview of all findings

Taking into account depressive symptoms as well as co-occurring symptoms of anxiety, alcohol dependence and drug dependence, we identified substantial heterogeneity in behavioral health profiles among women of young children. Mothers were identified as having the following mutually exclusive symptom profiles: depression and substance use, severe depression and anxiety, depression only, anxiety only, and currently symptom free. A history of mental health and substance use in the pregnancy and postpartum periods was associated with membership in all four symptomatic profiles. Women in depression profiles characterized by co-occurring anxiety or substance use were at greatest risk for a future depressive episode; instrumental social support slightly moderated this risk. And lastly, women with more complex, and likely more functionally impairing, behavioral health profiles were the most likely to report past year behavioral health services use. Compared to white women, black women were less likely to receive these services.

Creation of behavioral health symptom profiles

Chapter three identified mothers' behavioral health symptom profiles in their children's 3rd year, based on co-occurrence of 33 depressive, anxiety, and substance dependence symptoms. Latent class analyses suggested five distinct profiles, including: "Depression only" (14.5% of sample), "Severe depression and anxiety" (5.3%), "Anxiety only" (2.2%), "Depression and substance use" (1.4%), and "Currently symptom free" (76.6%). After adjustment, mother-reported behavioral health problems during her perinatal period was the most robust correlate of belonging to a symptomatic profile 2-3 years later. Women who reported functional limitations

or experienced recent relationship dissolution had increased odds of endorsing the "Severe depression and anxiety" profile. Women with higher parity and functional limitations due to health had higher odds of endorsing the "Depression only" profile.

Risk prediction of a major depressive episode (MDE) as a function of behavioral health profile

Chapter four estimated the extent to which belonging to a given behavioral health symptom profile in their children's 3rd year of life differentially predicted mothers' risk of MDE in their children's 5th year. MDE risk varied among the 24% of mothers with clinically significant behavioral symptom profiles. As hypothesized, mothers in the groups experiencing co-occurring depression with severe anxiety or substance misuse were most at risk for subsequent depressive disorder. Further, instrumental social support slightly decreased the risk for future MDE overall, but that risk did not differ by behavioral health profile. Other maternal characteristics associated with future disorder included cohabitating with a partner or being single (as opposed to married), reporting a recent fetal loss (either abortion or miscarriage), having 3 or more children, having current functional limitations, having probable MDE in the postpartum Year 1, and smoking during pregnancy.

Behavioral health profile membership and probability of BHC use

Chapter five estimated the association between maternal behavioral health symptom profile and past year use of BHC. We also estimated racial differences in the predicted probabilities of BHC use, accounting for a range of maternal characteristics. As hypothesized, mothers with more complex behavioral health profiles (e.g., "Severe depression and anxiety" compared to "Depression only") had the highest predicted probabilities of BHC use. Maternal

characteristics associated with higher probabilities of BHC use included older age, functional limitations due to health, perinatal behavioral health problems, and having Medicaid. Black and Hispanic women and women who were currently pregnant were less likely to report use of BHC.

LIMITATIONS AND STRENGTHS

Limitations

The contributions of this study should be considered in light of the following limitations related to its design. Despite rich and reliable behavioral health symptom information, we lacked detail on BHC use (e.g., timing, treatment dose, quality, and informal services use). More information on services would have helped us determine the extent to which mothers with clinically relevant symptoms accessed *adequate* and *timely* care, which studies relying on clinical-based information such as chart reviews or in-depth interviews in qualitative studies can examine. One of the more obvious moderators of current symptoms and risk for future symptoms might be use of behavioral health care services. However, due to lack of this BHC information we were unable to include BHC use as a moderator of future depression risk. Further, we acknowledge our study likely underestimates what current BHC use rates are today given that the Year 3 survey was administered in 2002-2003, prior to the passage of the Affordable Care Act, which expanded medical insurance coverage, particularly among low-income individuals.

This study also had the following limitations typical of studies that rely on health survey data. Behavioral health symptoms were self-reported, although they were systematically assessed using a well validated structured format in phone interviews. Moreover, mothers' own perceptions of her behavioral health symptoms and social supports are theoretically linked and

empirically known drivers of BHC care use and future disorder risk. Nonetheless, mothers are likely to have under-reported certain symptoms due to the social desirability or fear of being reported to child protective services (in particular for drug and alcohol use behaviors[126]), potentially leading to an underestimate of prevalence. This bias may be accentuated among racial/ethnic minorities who may distrust the medical system and health researchers more than whites.[127] Further, there are other potential influences mediating the relationship between behavioral health care need and BHC use that we were unable to explore in this study including attitudes and beliefs about help-seeking that affect decision-making, patient-provider communication, and perceived discrimination/racism in the health care system.

Finally, although a strength of the study is its focus on a highly vulnerable population at a critical life period, this also limits the generalizability of the study findings to populations that are generally similar. Also, it is not a true representative sample of low-income, mostly unmarried, predominantly minority mothers.

Strengths

Despite these limitations, this study advances the science on maternal behavioral health in the perinatal and early childhood periods, based on multiple strengths. Distinct from most studies related to reproductive behavioral health, this study examined a non-clinical population of mothers from across the U.S. (20 city sample). Participants of the FFCW study are a mostly unmarried, low-income, and racially diverse group of mothers. This population is particularly at risk for unmet mental health need yet has been historically understudied in national surveys. In addition, the behavioral health symptoms used to create risk profiles in **Chapter three** were

based on the Composite International Diagnostic Interview – Short Form, version 1.0 subscales,[70] which have been tested in a wide range of populations and have demonstrated good validity[71] and reliability.[72] We were also able to take advantage of rich maternal information related to reproductive health, perinatal behavioral health, social support and functional limitations to describe and adjust for variation in the social contexts of mothers' lives. Another strength of this study is that behavioral health need and behavioral health care use were measured within same reference period (e.g., both within the past 12 months), which is an improvement from many health utilization studies that ask only about lifetime services use and/or lifetime diagnosis. And lastly, this study utilized sophisticated analytic methods to answer the complex questions it posed, including: latent class analysis (LCA) to characterize person-based experiences of behavioral health symptoms[77] and modern missing data methods (e.g., multiple imputation with chained equations[74]) to reduce biases due to missing data.

IMPLICATIONS FOR PUBLIC HEALTH POLICY, PRACTICE, AND RESEARCH

Policy and practice

The primary contribution of this study is the characterization of maternal behavioral health symptom profiles in a way that may be more synchronous with the clinical observations of obstetrics providers than focusing on specific disorders, which women may not fully meet criteria for and which typically focuses clinical attention on only one of the presenting problems. Further, this study showed that women with symptoms across the behavioral health spectrum—depression, anxiety, substance misuse—are most in need of care, especially to prevent future major depressive episodes. Given the challenges of creating effective screening programs,[2,86] it is helpful that this study indicates that the most impairing and risky profiles are those involving

significant depressive symptoms. Depression screening has the strongest evidence base and is more generally accepted in clinical settings. Systematic screening for depression and effective referral and engagement will identify the majority of low-income young mothers with significant problems. The observed low levels of BHC use among mothers with significant behavioral health symptoms, especially among pregnant women, and among women of color, emphasizes the importance of the perinatal period for the amelioration of symptoms and prevention of serious psychiatric disorders. While ACOG recommends screening for depression and anxiety "at least once" in the perinatal period, the American Academy of Pediatrics recommends more frequent screening.[2] Future studies demonstrating that more frequent prenatal screening improves outcomes would align with the current strategic plan of the National Institute of Mental Health, which emphasizes supporting primary care efforts of behavioral health risk detection early in the course of disorder development.[128]

Despite professional guidelines in support of screening for perinatal mood disorders,[2,24] there are multiple practice and policy barriers to integrating behavioral health screening, referral and follow-up in obstetrics. First and foremost there are inadequacies in medical provider education in reproductive mental health, among psychiatrists themselves[129] and obstetricians.[86] In a recent survey of obstetricians, commonly identified barriers to postpartum screening included lack of time, lack of training and lack of knowledge about diagnostic criteria.[120] Efforts from the National Task Force on Women's Reproductive Mental Health[129] and the Council on Patient Safety in Women's Health Care[130] are examples of recent multidisciplinary efforts to address maternal behavioral health that are promising.

Following current practice guidelines to incorporate routine screening and effective behavioral health care referral into primary obstetrics and pediatrics care could go a long way to improving women's health.[2] However, routine screening alone is insufficient if health care delivery systems are not structured in a way that facilitates engagement in behavioral health care. Specific models that show promise include stepped models of care[117] and collaborative care models.[131]

Medicaid, in particular, has the potential to be hugely influential, given that it is the largest provider of health insurance for both low-income populations and individuals with behavioral health problems[63] and provides nearly half of the perinatal medical care in the U.S.[62] Medicaid already reimburses pediatric and obstetrics providers for maternal behavioral health screening,[132] but this is not enough. Beyond reimbursement for screening, providers need better training to understand the results of positive screens and treatment options and clinic managers need better systems in place to facilitate trusted referrals and behavioral health management protocols.

Research

This study contributes to the literature on behavioral health among low-income and unmarried mothers early in their families' life cycle. It was beyond the scope of this study to incorporate fathers' behavioral health symptoms, previously found to be disproportionately higher among FFCW mothers with mental health risk.[41] Further, studies of FFCW participants found that better quality couple relationships and higher emotional support were associated with fewer maternal depressive symptoms in the postpartum[44] and early childhood periods.[58,60,100] At least one study that relied on an adolescent parents sample demonstrated that mental health and relationship quality influenced young parents' mental health services use.[133] Taken together,

these studies demonstrate that relationship quality and social support are dynamic processes that impact mental health and potentially mental health help-seeking of married and unmarried couples. However, none of these studies took into account the behavioral health symptoms of the biological fathers. Future research could characterize family-level behavioral health risk, incorporating symptoms from the four psychiatric disorders in this study, as well as other markers of behavioral health risk such as trauma exposure and history of incarceration. Better characterizing the role that couples' behavioral health risk profiles play in family trajectories could emphasize the importance of integrating a family-oriented focus into medical care and support social programs outside of the medical care system aimed to strengthen romantic relationships and father involvement in fragile families.[134]

This study demonstrated that the probability of behavioral health services use varied by maternal behavioral health profile. Yet, one of the limitations of this study was the limited information available to describe timing, duration, and quality of those services. Future studies, based on datasets with more robust information about mental health services use (e.g., National Comorbidity Study; Postpartum Depression: Action Towards Causes and Treatment), could explore the relationship between time-varying behavioral health risk profiles and 1) unmet behavioral health care need, 2) delays in care between symptom onset and services use, and 3) adequacy and quality of care received. This more detailed look, especially in a national sample, would move us closer to pinpointing areas needing improvement, as well as facilitators and barriers to timely and quality behavioral health care.[34] Qualitative research with low-income and minority mothers can also contribute to understanding their own and their partners' efforts to address behavioral health problems and their experiences of help-seeking. This type of

information will be critical to designing coordinated systems of obstetric and behavioral health care that are acceptable and engaging.

There is some evidence that changes in health care delivery models can improve maternal mental health in the perinatal and early childhood periods. Infrastructures that support universal screening,[121] co-located services, and stepped models[117,131] in obstetrics show promise. For example, Grote and colleagues demonstrated the feasibility and efficacy of a stepped- and collaborative-care model among a racially/ethnically diverse Medicaid population to address maternal depression from pregnancy through 18 months postpartum in a public hospital system.[131,135] Broader demonstration studies are needed to test the dissemination of integrated primary and behavioral health care services for mothers, including anxiety and substance misuse symptom assessment, as well as evaluations that include an assessment of sustainability. This might make the most sense to test in a single health insurance company or across a hospital system with wide reach. Early phases of this work would necessarily include qualitative work to better characterize patient help-seeking attitudes, especially among women of color, other subgroups beyond race/ethnicity (e.g., nativity, religiosity) and current attitudes and practices of obstetricians and other primary care providers related to mental health care knowledge, screening, referral and follow-up of their patients at risk for behavioral health disorders.

CONCLUSIONS

This study identified unique maternal behavioral health symptom profiles that cut across psychiatric disorders, including depressive, anxiety, and substance dependence symptoms. We found that these profiles had unique precursors and differentially predicted subsequent serious mental health problems. This work aligns with the National Institutes of Mental Health's Research Domain Criteria Initiative (RDoC), an approach that promotes person-centered rather than disorder- and variable-focused studies.[37,38] The profiles articulate the RDoC perspective by characterizing patterns of significant symptoms associated with functional limitations, acknowledging that an individual may not meet full criteria for each disorder. These findings highlighted the role of social support in reducing mothers' future disorder risk. They also indicated the persistence of racial disparities in BHC use. Further, the observed low levels of BHC use among mothers who are pregnant suggests missed opportunities for timely treatment and prevention of the sequelae of these conditions, including future psychiatric disorders. This study adds to the research that calls for integrating behavioral health services into gynecologic and obstetric care.[2,27,121,124] Such efforts will require a coordinated and concerted effort on the part of obstetricians, psychiatrists and other mental health providers, and hospital administrators to design and finance provider training and services to ensure that these problems are quickly identified and managed. Such an interdisciplinary approach to behavioral health has the potential to improve women's quality of life, their birth outcomes, children's development, family functioning and to reduce the cross-generational transmission of behavioral health problems.

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Appendix A. Institutional Review Board Determination Notice

FWA #00000287

Institutional Review Board Office

615 N. Wolfe Street / Room E1100
Baltimore, Maryland 21205-2179
Phone: 410-955-3193
Toll Free: 1-888-262-3242
Fax: 410-502-0584
Email: jhsph.irboffice@jhu.edu
Website: www.jhsph.edu/irb

NOT HUMAN SUBJECTS RESEARCH
DETERMINATION NOTICE
STUDENT PROJECTS

Date: July 12, 2016

To: Nomi Weiss-Laxer

Re: **PhD Dissertation Student Project Title:** "Mental Health Care and Substance Abuse Treatment Utilization among Pregnant Women and Mothers of Young Children"

The JHSPH IRB reviewed the IRB Office Determination Request Form for Secondary Data Analysis (received 7/7/16) on **July 11, 2016**. We have determined that the proposed activity described in your request form will undertake secondary data analysis of an existing, de-identified and de-linked, publicly available dataset from the Fragile Families and Child Well-being (FFCW) study. Thus, the proposed activity does not qualify as human subjects research as defined by DHHS regulations 45 CFR 46.102, and does not require IRB oversight.

You are responsible for notifying the JHSPH IRB of any future changes that might involve human subjects and require IRB review.

If you have any questions regarding this determination, please contact the JHSPH IRB Office at (410) 955-3193 or via email at jhsph.irboffice@jhu.edu.

ES/teb

cc Anne Riley, PhD
Faculty Advisor / Professor
Department of Population, Family and Reproductive Health
Johns Hopkins University Bloomberg School of Public Health

CURRICULUM VITAE

Nomi Weiss-Laxer, M.P.H., M.A.

BIRTHPLACE

Sacramento, California

EDUCATION

Ph.D., Bloomberg School of Public Health, Johns Hopkins University (anticipated, December, 2018)
Dissertation: "Maternal Behavioral Health Symptom Profiles in Early Family Life: Complexity, Support, Services Use, and Future Risk for Depression"
Department: Population Family and Reproductive Health
Track: Child and adolescent health and development

M.P.H., Brown University (2008)
Focal areas: Unintentional childhood injuries; program evaluation

M.A., Tulane University (2005)
Latin American Studies
Focal areas: International health and development; sociology; qualitative methods

B.A., Vassar College (2001)
Major: Political science
Minor: Hispanic studies

SUMMARY

My research characterizes behavioral health symptoms among pregnant and parenting mothers to improve health promotion initiatives and health care delivery systems. I have over 15 years of experience working with low-income and minority families as a health educator and social scientist.

WORK EXPERIENCE

Research Coordinator, U.S. Maternal and Child Health Bureau Measurement Research Network, Family Health Technical Working Group, P.I. Christina Bethell, Department of Population, Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health (2017-*present*)

Research Assistant, Maternal Mental Health Promotion Initiative, Johns Hopkins (2015-*present*)

Adjunct Lecturer, School of Nursing and Health Studies, University of Miami (2010-2013)

Project Manager, Pan American Health Organization/World Health Organization Collaborating Center for Nursing Human Resources, School of Nursing and Health Studies, University of Miami (2009-2011)

Senior Research Associate, Injury Prevention Center, Emergency Medicine Department, Rhode Island Hospital (2006-2008)

Clinical Research Assistant, Child and Family Psychiatry Department, Rhode Island Hospital (2005-2006)

Health Educator and Crisis Counselor, The Door: A Center of Alternatives, New York (2001-2003)

PEER-REVIEWED PUBLICATIONS

Platt, R., **Weiss-Laxer, N**., Creedon, T., Sanchez, M.J., Cardemil, E. & Cook, B. (under review). Association between maternal and child mental health in US Hispanics: Variation by nativity, ethnic subgroup, and time in the US. *Social Science and Medicine.*

Weiss-Laxer, N., Platt, R., Osborne, L.M., Kimmel, M., Solomon, B.S., Mendelson, T., Webb, L., & Riley, A.W. (Jan 2016). Beyond screening: A review of pediatric primary care models to address maternal depression. *Pediatrics Research*, 79(1-2):197-204. doi: 10.1038/pr.2015.214

Mitrani, V.B., Feaster, D.J., **Weiss-Laxer, N.S**., McCabe, & B.E. (2011). Malaise, motivation and motherhood: predictors of engagement in behavioral interventions from a randomized controlled trial for HIV+ women in drug abuse recovery. *AIDS and Behavior*, 15(2):396-406.

Beletsky, L., Agrawal, A., Moreau, B., Kumar, P., **Weiss-Laxer, N**., & Heimer, R. (2011). Police training to align law enforcement and HIV prevention: preliminary evidence from the field. *American Journal of Public Health*, 101(11):2012-5.

Mitrani, V.B., McCabe, B.E., Robinson, C., **Weiss-Laxer, N.S.**, & Feaster, D.J. (2010). Structural ecosystems therapy for recovering HIV-positive women: child, mother, and parenting outcomes. *Journal of Family Psychology*, 24(6):746-55.

Park M.J., Baldwin K.B., **Weiss-Laxer, N.**, Christian J., Eberson C., Mello M.J., & Spiegel D. (2010). Local playground safety scores in a low-income community and rate of supracondylar fractures of the humerus: An ecologic study. *Journal of Pediatric Orthopedics,* 30(2):101-5.

Young, E.E., Nguyen, B.T., **Weiss-Laxer, N.S.**, Sigman, M., & Nolan, P.A. (2010). Factors associated with family planning and vasectomy discussions: Results from a health provider survey. *Medicine & Health Rhode Island*, 93(2): 48-50.

Weiss-Laxer, N., Mello, M.J., & Nolan, P. (2009). Evaluating an educational component of a hospital-based child passenger safety program. *Journal of Trauma: Injury, Infection, and Critical Care*, 67(1):S30-S33.

Mitrani, V.B., **Weiss-Laxer, N.S.**, Ow, C.E., Burns, M.J., Ross-Russell, S., & Feaster, D.J. (2009). Examining family networks of HIV+ women in drug recovery: Challenges and opportunities. *Families, Systems, and Health,* 27(3):267-83.

Mitrani, V.B., **Weiss-Laxer, N.S.**, & Feaster, D.J. (2009). Factors related to loss of child custody in HIV+ women in drug abuse recovery. *The American Journal of Drug and Alcohol Abuse*, 35:5, 320-324.

McQuaid, E.L., **Weiss-Laxer, N.**, Koinis Mitchell, D., Nassau, J.H., Wamboldt, M.Z., Klein, R.B., & Fritz, G.K. (2008). Pediatric asthma and problems in attention, concentration, and impulsivity: Disruption of the family asthma management system. *Families, Systems, and Health*, 26(1): 16-29.

OTHER PUBLICATIONS

Riley, A. & **Weiss-Laxer, N**. (May, 2014). Perinatal depression is not being well addressed, putting mothers and families at risk: Role of psychologists in improving depression diagnosis and management in obstetrical and family practices. *The American Psychological Association CYF News.* http://www.apa.org/pi/families/resources/newsletter/2014/05/perinatal-depression.aspx

MANUSCRIPTS IN PROGRESS

Hughes, M.E., Crandall, A., **Weiss-Laxer, N.,** & Riley, A. Families in a 21st century approach to public health education, policy and practice. To be submitted 11/2018 to the *American Journal of Public Health.*

Weiss-Laxer, N., Johnson, S., Ghazarian, S. & Riley, A. Person-based maternal behavioral health profiles in early family life: Complexity and context. To be submitted 11/2018 to the *Archives of Women's Mental Health.*

Weiss-Laxer, N., Johnson, S., & Riley, A. Behavioral health symptoms among mothers of 2-3 year-olds and depression risk 2 years later: the role by social support and mental health care use. To be submitted 12/2018 to *Prevention Science.*

Weiss-Laxer, N., Johnson, S. & Riley, A. Symptom profile-specific racial health disparities in mothers' use of mental health care. To be submitted 12/2018 to *Social Science and Medicine.*

CONFERENCE PRESENTATIONS

Weiss-Laxer, N., Johnson, S., Ghazarian, S. & Riley (November, 2018). Complexity of maternal mental health problems early in family life: A latent class analysis. To be presented at the American Public Health Association annual meeting, San Diego, CA.

Kalfoglou, A., Mendelson, T., **Weiss-Laxer, N.**, Brar, A., Edwardson, J., Bucay, L., Sinit, R. & Anne Riley (November, 2018). Patient and provider perspectives on group-based obstetrics care to reduce perinatal mood and anxiety disorders. To be presented at the American Public Health Association annual meeting, San Diego, CA.

Hughes, M.E., Crandall, A., & **Weiss-Laxer, N.,** & Riley, A. (November, 2018). Families in a 21st century approach to public health. To be presented at the National Council on Family Research meeting, San Diego, CA.

Weiss-Laxer, N., Mendelson,T., Kalfoglou, A., Edwardson, J., Brar, A., Bucay, L., Sinit, R., & Riley, A.W. (April, 2018). Perspectives of Latina and Non-Latina Urban Obstetrics Patients and Providers on Group-Based Preventive Services for Mental Health Problems. North American Society for Psychosocial Obstetrics and Gynecology meeting, Philadelphia, PA.

Weiss-Laxer, N., Gonzalez-Guarda, R., Campos, N., Deleon, D., Mitchell, E.M., Choudhury, S., & Peragallo, N. (October, 2012). "Cultivating University and Community Partnerships in the Development of an Undergraduate Public Health Program." Presented at the American Public Health Association annual meeting, San Francisco, CA.

Young, E.E., Nguyen, B., **Weiss-Laxer, N.**, Sigman, M. & Nolan, P. (November, 2009). "Factors Associated with Family Planning and Vasectomy Discussions: Results from a State-Wide Health Provider Survey." Presented at the American Public Health Association meeting, Philadelphia, PA.

Mitrani, V.B., **Weiss-Laxer, N.S.**, Ow, C.E. & Feaster, D.J. (July, 2009). "Exploring the Family Networks of HIV+ Women in Drug Recovery: Research Challenges and Opportunities." Presented at the 20th International Nursing Research Congress Focusing on Evidence-Based Practice, Vancouver, British Columbia, Canada.

Weiss-Laxer, N., Mello, M.J., & Nolan, P. (December, 2008). "Evaluating a New Educational Component of a Hospital-Based Child Passenger Safety Program." Presented at the Injury Free Coalition for Kids Conference, Ft. Lauderdale, FL.

Perron-Burdick, M., **Weiss-Laxer, N.**, & Mello, M.J. (November, 2007). "Screen Time and Physical Activity: Are Kids Ready for Change?" Presented at the American Public Health Association meeting, Washington, DC.

McQuaid, E., Koinis Mitchell, D. Kopel, S., **Weiss-Laxer, N.**, Nassau, J., Klein, R., Wamboldt, M., & Fritz, G. (April, 2006). "Symptoms of Attention Deficit Hyperactivity Disorder in Children: Relationships with Features of Family Asthma Management." Presented at the Child Health Psychology Conference, Gainesville, FL.

INVITED PRESENTATIONS

Weiss-Laxer, N. Maternal behavioral health symptom profiles in early family life. (June, 2018). Invited Brown Bag lecture, Program of Public Health, Stony Brook University.

Riley, A.W., Crandall, A., Okano, L.J., **Weiss-Laxer, N**. (August, 2017). Review of Progress: Family Health Technical Working Group, Maternal Child Health-Measurement Research Network Advisory Committee Meeting, Bethesda, MD.

Weiss-Laxer, N. "Patient-Provider Communication and HIV Prevention in Santiago, Dominican Republic." (March, 2007). Invited speaker at International Woman's Day event, sponsored by United for Choice and Planned Parenthood of Rhode Island, Providence, RI.

TEACHING EXPERIENCE

Teaching Assistant, *Johns Hopkins University, Bloomberg School of Public Health*
Graduate-level course: Focusing on Family to Promote Population Health (Spring, 2015)

Instructor, *University of Miami, School of Nursing and Health Studies*
Undergraduate-level course: Introduction to Public Health (Fall and Spring, 2010-2013)
Undergraduate-level course: Health Promotion and Disease Prevention (Fall, 2010-2013)
Undergraduate-level course: Global Health (Spring, 2010-2013)

SERVICE

Student Member, Family Health Workgroup, Department of Population Family and Reproductive Health, Johns Hopkins Bloomberg School of Public Health (2013-present)

Search Committee Member, For Associate Dean of Health Studies, School of Nursing and Health Studies, University of Miami (2012 –2013)

Vice Chair, Public Health Planning Committee, School of Nursing and Health Studies, University of Miami (2010-2013)

PROFESSIONAL AFFILIATIONS

American Public Health Association
National Council on Family Relations
North American Society for Psychosocial Obstetrics and Gynecology

HONORS AND AWARDS

C. Sylvia and Eddie C. Brown Community Health Competitive Doctoral Scholarship. Tuition, stipend, and research support for community-based project, Hopkins Bloomberg School of Public Health (2013-2018)

Fragile Families and Child Wellbeing Summer Institute Scholarship, Columbia University(2016)

Safe Kids Scholarship, National Child Passenger Safety Program (2007)

M.P.H. research assistantship and stipend, Brown University (2006–2008)

Foreign Language Area Studies fellowship and stipend, Stone Center for Latin American Studies, Tulane University (2003-2005)

Latin Americanist Graduate Organization Outstanding Student Service Award, Tulane University (2005)

Undergraduate thesis award "distinction" Vassar College (2001)

METHODS TRAINING

Quantitative data analysis: Doctoral-level coursework in regression, psychosocial methods, latent class analysis, longitudinal data analysis; data management and analysis in STATA, Mplus, and Excel

Qualitative data analysis: Data management and analysis in Dedoose qualitative software**;** graduate-level coursework in qualitative and mixed methods

OTHER TRAINING AND SKILLS

Certificate in Maternal and Child Health (*Population Family and Reproductive Health Department, Bloomberg School of Public Health, Johns Hopkins University*), 2018

Playground Safety training (*National Playground Safety School)*, 2007

National Child Passenger Safety certification (*Safe Kids*), 2006

Fluent in written and spoken Spanish

Proficient in written and spoken Brazilian Portuguese